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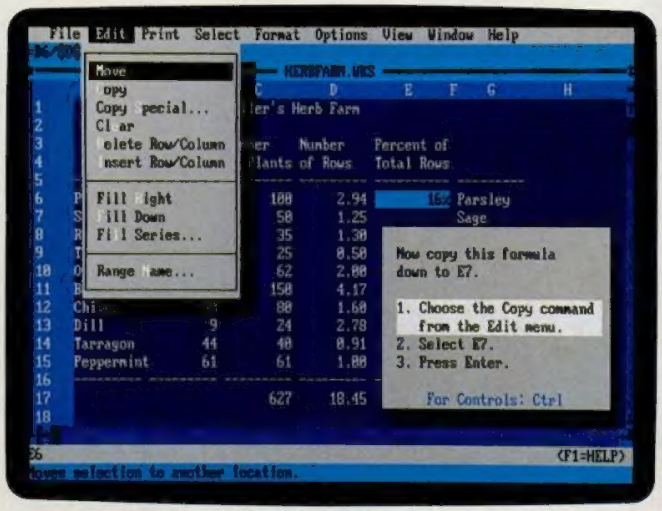

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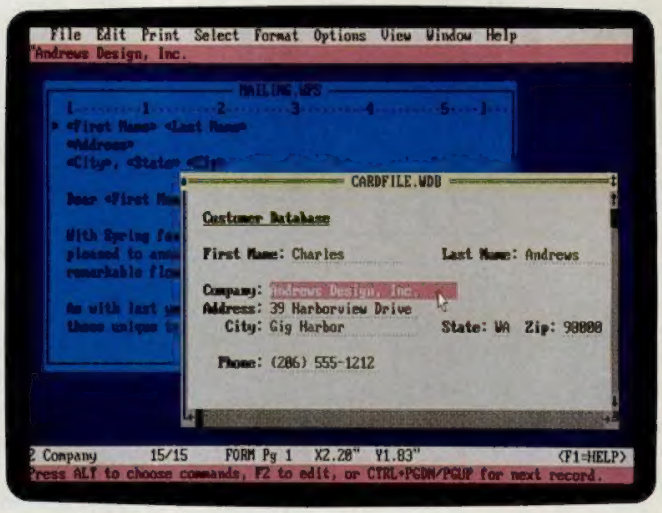

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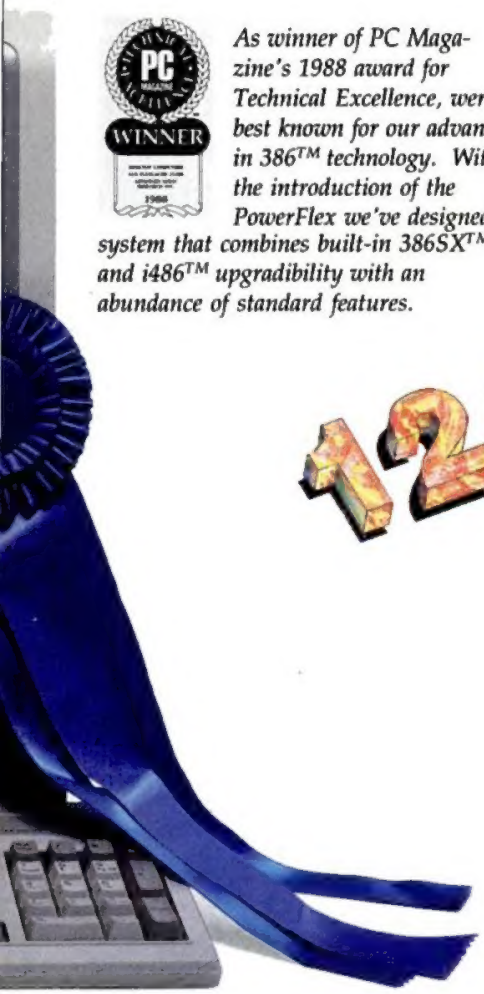
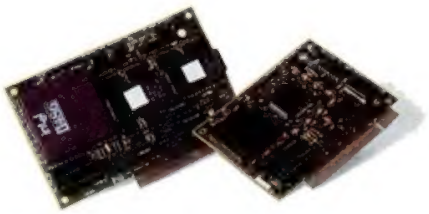


As winner of PC Magazine's 1988 award for Technical Excellence, were best known for our advances in 386™ technology. With the introduction of the PowerFlex we've designed a system that combines built-in 386SX™ and i486™ upgradibility with an abundance of standard features.

The ALR PowerFlex comes standard with 1-MB of main memory with built-in hardware EMS 4.0 support lets you immediately break the 640-Kb barrier to run all memory intensive applications.



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The powerful 40-MB hard disk which is standard equipment on the PowerFlex provides storage for approximately 20,000 pages of documentation .

At ALR, we've built our reputation on delivering premium PCs without the premium price. The new PowerFlex 286-based PC combines performance, quality and innovation for only $1495. Compared to the competition, the PowerFlex is the premium 286-based PC.

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The PowerFlex delivers

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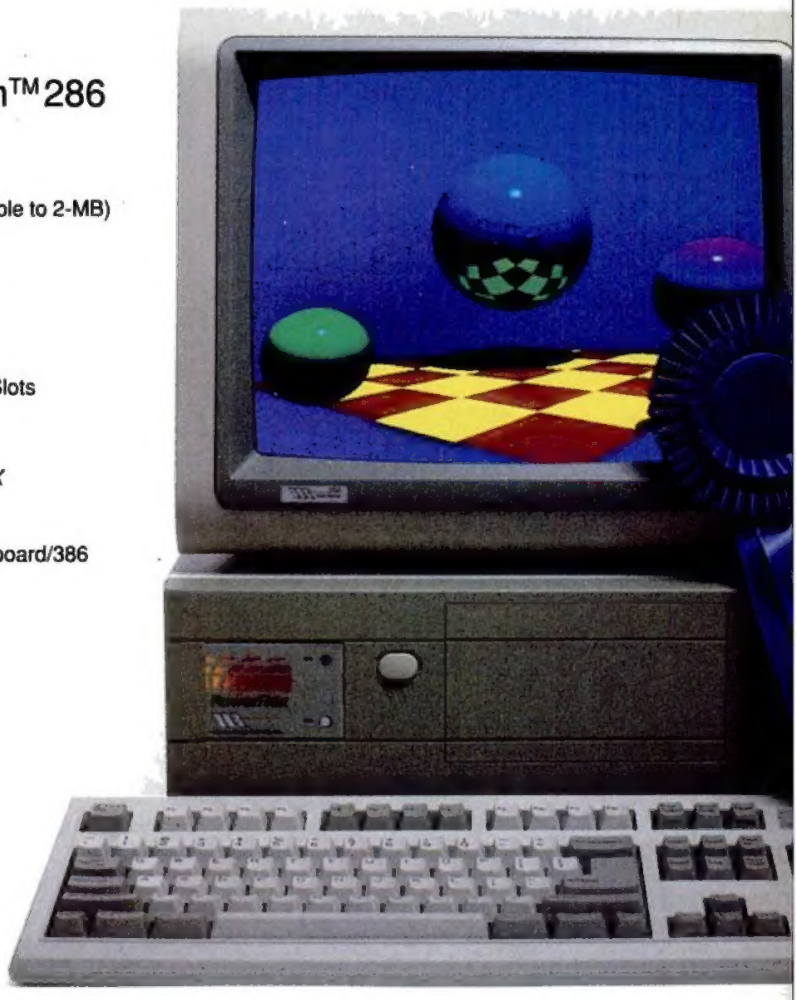

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Inside

PC Magazine is used to doing things in a big way. From single-topic issues with 100 or more products to features tables the size of handball courts, there's very little we do on a small scale.

But not every vital product category in the computer industry demands a 50,000-word story. There are myriad nonmainstream business applications that are essential to the daily lives of our readers, as well as upgrades of important products—both of which are often better suited to a shorter format than a multiproduct roundup. Thus the "short feature" was born.

It's often the case that the smaller a project, the greater the preparation necessary. Our short features will boast the extensive testing you're used to seeing on these pages, but presented in a concise fashion. We'll get right to the meat of the story, giving you the information you need to make an intelligent buying decision. Typically, the short feature will run 4 to 5 pages.

First up are paint programs, examined by contributing editor Luisa Simone. A five-year veteran of *PC Magazine*, Simone has held several positions from assistant managing editor to executive editor. Last year Simone was among the editors who formulated the short-feature concept, making her an obvious choice as the reviewer for our first attempt in the short format.

"What these stories attempt to do is get down to the nitty-gritty product information that you get from your better-informed friends over the phone," Simone explains. "Because of their condensed nature, the reviews get to the heart of the matter much more quickly. We'll tell you why you would want to use these products, and whether they do what they should."

The four paint packages each cost under $100 and support the full VGA palette of 262,000 hardware colors. Simone found out that price and value don't necessarily correlate. "There are some amazing low-cost programs out there. None of them is perfect, but they do provide a lot of the functionality of expensive programs. Besides that, they're fun."

So many products, so little time. Contributing editor Luisa Simone doesn't review *everything* about paint programs—just which ones to buy and why.

Budget plays a part in another of this issue's feature stories: low-end integrated software. The seven packages go for less than $200 each and include word processing, database, and spreadsheet modules with a common interface.

After failing to live up to inflated expectations years ago, these almost-all-you'll-ever-need products are making a comeback. With extras such as graphics, communications, and desktop utilities, they've come to represent a remarkable value. The laptop-toting executive may find that one integrated software package on a 720K 3.5-inch disk can make life on the road just a little less bumpy.—**Stephanie K. Losee** ■

PHOTOGRAPHY: THOM O'CONNOR

PC Magazine: The Independent Guide to IBM-Standard Personal Computing, ISSN #0888-8507, is published biweekly except in July and August for $44.97 for one year (22 issues). Additional postage $1.41 per copy or $31.00 per year for Canada and all other foreign countries. Ziff-Davis Publishing Co., a division of Ziff Communications Co., One Park Ave., New York, NY 10016. Second-class postage paid at New York, NY 10016 and at additional mailing offices. POSTMASTER: Address changes to *PC Magazine*, P.O. Box 54093, Boulder, CO 80321-4093.

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Everything it takes to add PostScript to your LaserJet II, including HP's blessing.

"The QMS JetScript controller is the best way available to add PostScript capabilities to a Hewlett-Packard LaserJet Series II printer."

–PC Week
Sept. 19, 1988

Hewlett-Packard* and QMS* have made it easy to give your LaserJet Series II* the desktop publishing power of the PostScript* page description language.

The new QMS JetScript™.

JetScript is the only Adobe PostScript controller upgrade authorized by HP and designed specifically for the LaserJet Series II. JetScript gives your printer the industry-standard page description language to accompany HP's PCL printer language. This expands your laser printing capabilities. Increases overall printer performance. Yet preserves HP functionality and warranties.

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Simply, PostScript opens up the full range of possibilities for desktop publishing. You have complete control over the final look of the page, down to the last exacting detail. PostScript allows for an infinite number of font variations and sizes. That makes PostScript's limitless flexibility and power the perfect complement to your LaserJet Series II, giving you the high-quality output you require.

Impressive results People have come to expect impressive results from QMS—one of the first companies to bring the power of PostScript to laser printing, and now with more PostScript-based products than any other company.

You'll get the same results from the new JetScript. After all, it has HP's blessing.

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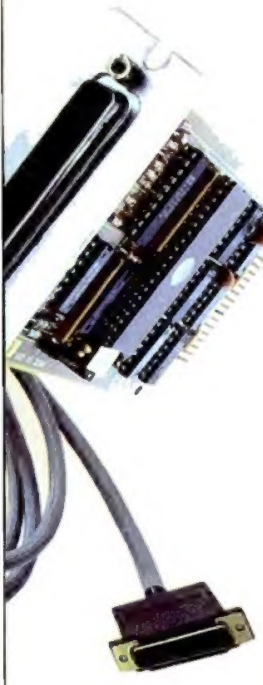

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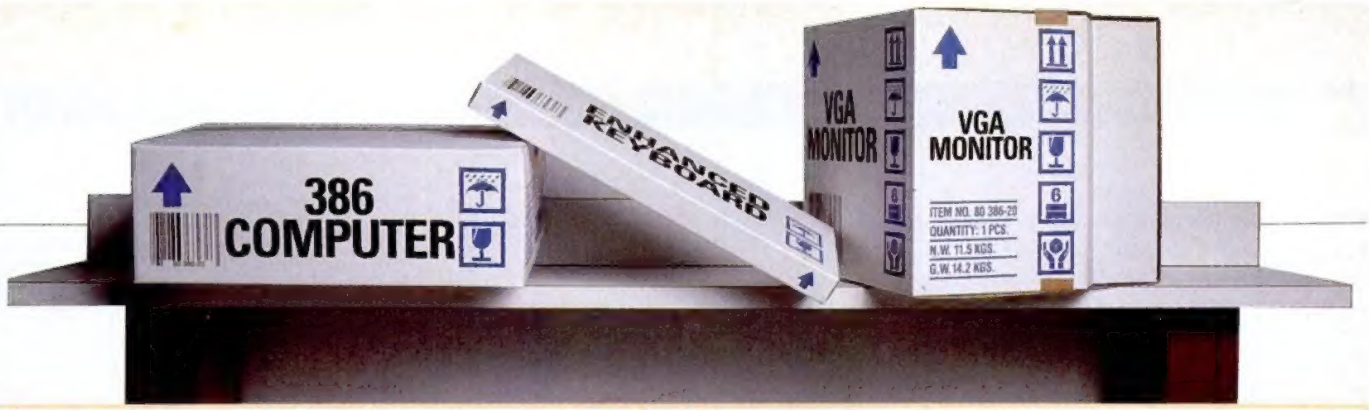

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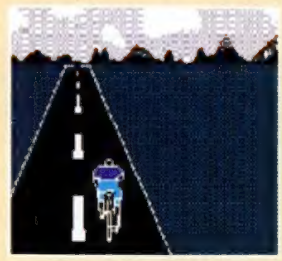

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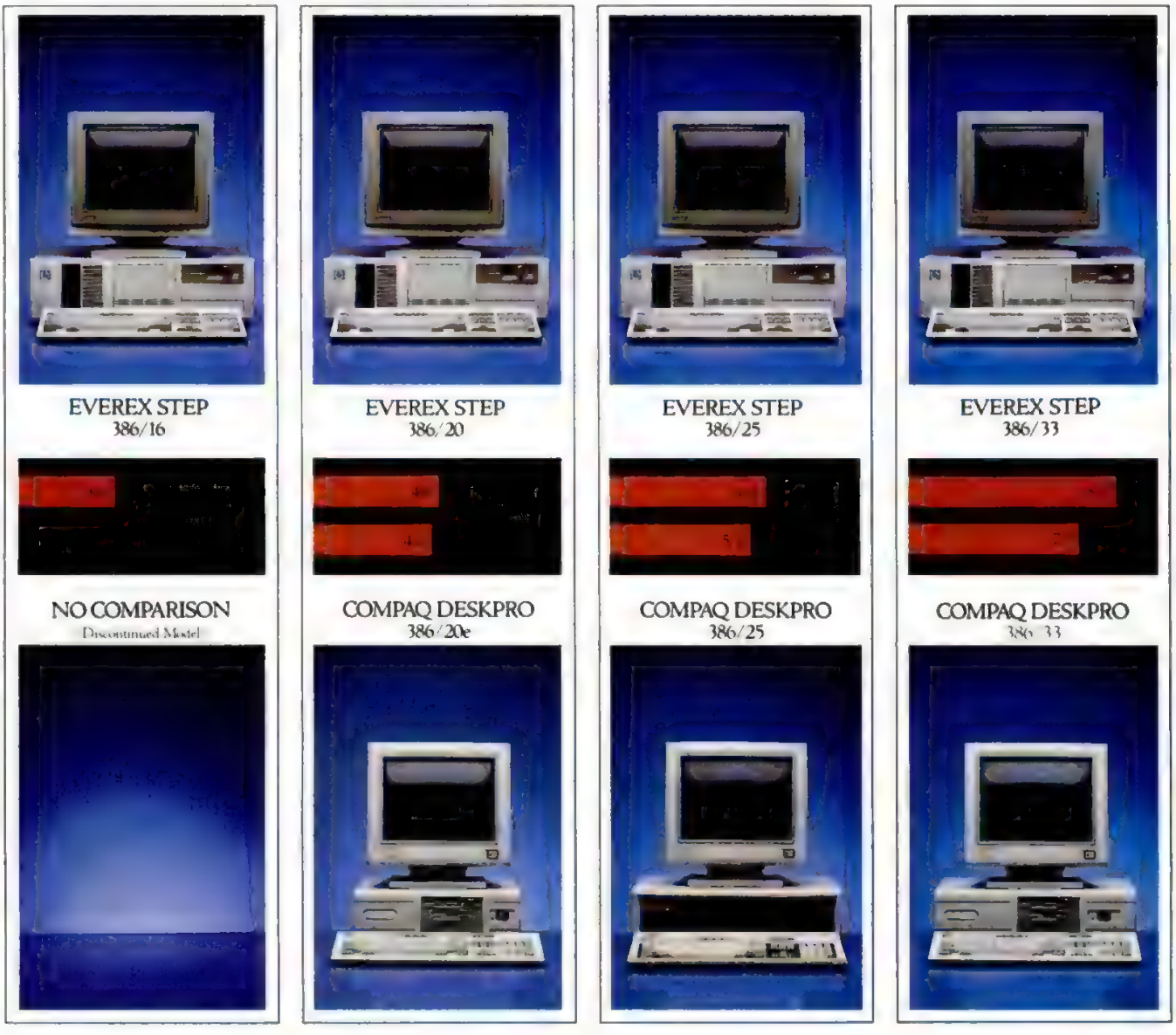

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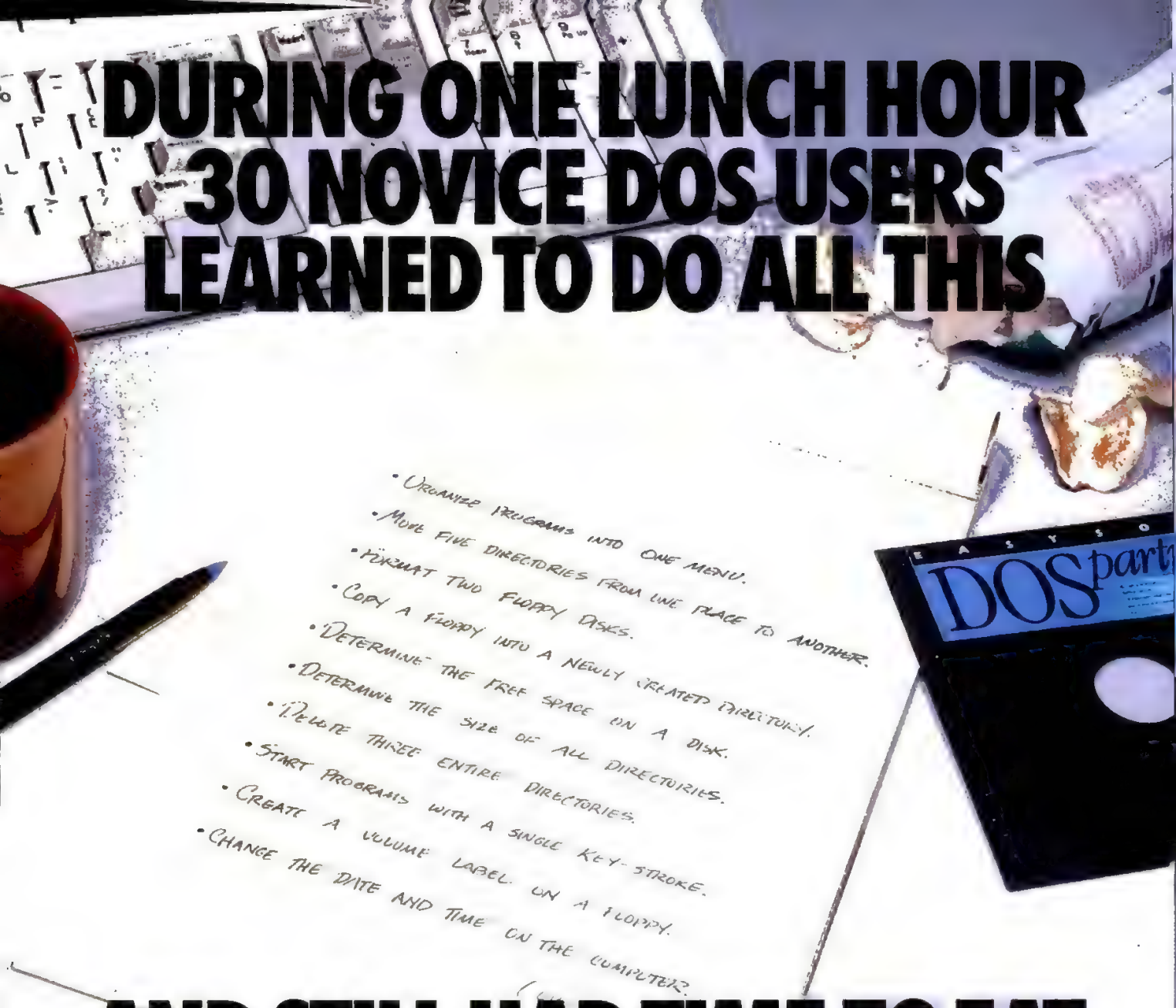

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E A S Y S O F T

CIRCLE 222 ON READER SERVICE CARD

Letters

SLIP ART?

I was very pleased to see the in-depth review of *Arts & Letters Graphics Editor* in your recent roundup of clip-art packages ("PC-based Clip Art: Instant Images," *PC Magazine*, October 17, 1989). While I still believe that the program should have been included in your earlier review of PC illustration packages ("Fine Lines: The PC as Illustrator," *PC Magazine*, June 27, 1989), Robin Raskin's article helped atone for the omission by providing an excellent summary of *Arts & Letters*' fine freehand drawing capabilities.

Unfortunately, you did your readers a big disservice by not naming it an Editor's Choice product. No other program you reviewed comes even remotely close to this package in terms of features, speed, compatibility, flexibility, or ease-of-use.

Furthermore, your conclusion that "no one clip-art package will satisfy all needs, not to mention all tastes" was a huge cop-out. If you took this attitude in your other reviews, then you would never award an Editor's Choice: certainly no spreadsheet or word processing program will satisfy all needs and tastes.

Bill Bailey
Detroit, Michigan

If you felt that your review of *Arts & Letters Graphics Editor* in the October 17, 1989, issue of *PC Magazine* would quiet the complaints about your neglect some months ago, let me disabuse you.

Reviewing *Arts & Letters* as a source of clip art is equivalent to reviewing a PS/2 as a paperweight, or the space shuttle as accommodation for a small group of tourists. Either will serve in the reviewed capacity—as *Arts & Letters* provides an extensive and exceptional supply of graphics. But neither is primarily used for the cited function.

Let me add one more criticism of your review: faulting *Arts & Letters* for producing blue graphics indicates that your reviewer did not take the time to learn the rudiments of the program. One can select

Instant feedback: readers respond to our look at clip-art packages.

the color, shading, and other properties of any graphic either at creation or at any later time. By leaving the choice to the designer, Computer Support Corp. has ensured that maximum flexibility is readily at hand for any user.

Michael Richter
Los Angeles, California

PC Magazine's clip-art roundup included not only clip-art packages, but graphics packages that offer clip-art libraries; these included *Arts & Letters Graphics Editor*, *Freelance Maps*, *Harvard Graphics Accessories*, and *Micrographx ClipArt Libraries*. In the reviews, the graphics and draw features of these packages were discussed only in terms of their usefulness for modifying each product's clip art.

In her review of *Arts & Letters*, Robin Raskin correctly stated that the color for most of the clip-art images is blue, and that the color can be modified manually. She criticized this color choice because blue maps poorly to black-and-white output devices.

The Editor's Choice sidebar recommends the best clip-art package in each of several categories because of the unique nature of the subject. Unlike word processors, for example, clip art is characterized by style. One package may offer the largest number of images or the greatest variety of options, but if the library's illustrations are the wrong style for your company's newsletter the package is of no use.

CHILD PRODIGY

Sure, the Prodigy Interactive Service is slow, less flexible than one would like, and pitched at the technologically unsophisticated (After Hours, *PC Magazine*, October 17, 1989). But I can do virtually everything on Prodigy that I could do on CompuServe, and at a small fraction of the cost. I still use CompuServe for downloads and to access PC MagNet, but using Prodigy for most of my on-line information retrieval and travel planning has saved me a small fortune. For that, I will put up with facile GUIs and a slight drop in speed.

And just to let you know, I use Prodigy with a number of TSRs and device drivers loaded and have had no problems at all.

David Welch
Cambridge, Massachusetts

I agree completely with Lori Grunin's review of the Prodigy Interactive Service. One shortcoming she failed to mention, however, is that if you want to go to Prodigy while already using your computer, you need to shut down or reboot from the floppy disk. I can't see too many users wanting to do that.

Your other comments regarding Prodigy's RAM use and lack of innovation are right on target. I purchased the Starter Kit, read the documentation, and immediately called to cancel. After I had explained my reasons for not taking the service (in detail), the operator—who apparently knew nothing about computers—said, "So you're canceling because it's too difficult to use?" I said "right" and hung up.

Lew Pinsker
Flemington, New Jersey

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CIRCLE 180 ON READER SERVICE CARD

Letters

Your review of the Prodigy Interactive Service indicated that stock information *cannot* be printed. In fact, it can. There is a print option on all Quote Track screens.

Orrin S. Edwards
Mineola, New York

PC MAGAZINE As Edwards and several other readers have pointed out, the Quote Track service on Prodigy allows you to print out stock information; at review time, however, this capability was not available. On-line services change more quickly than we can reflect, and Prodigy is no exception.

A TALE OF TWO MARKETS

John C. Dvorak tells us that 386 and 486 machines can no longer be held back by 8088 code (Inside Track, *PC Magazine,* October 17, 1989), and that by 1990 or 1991 there will be two distinct PC markets. Well, what exactly does he think the *existing* market is? Homogeneous?

The proliferation of packages written specifically for the 386 machine has already split the PC market between the office configuration—in our case, PS/2 Model 70s—and the home market, made up primarily of ATs and XTs. There are, at this very moment, too many things that I can do at the office that are not readily transportable to the home PC. I can see the two distinct markets *now,* and while it is not particularly comforting to know that the introduction of the 486 will further polarize the two segments, at least it will have the beneficial effect of pushing 386 prices (eventually) toward the home market range.

Tom Palermo
Kingwood, Texas

SETTING THE STANDARD

I enjoyed John Dvorak's column on the software compatibility dilemma (John C. Dvorak, *PC Magazine,* October 17, 1989). I even agreed with most of what he said. However, Mr. Dvorak snuck in a very broad comparison of IBM and Compaq in order to support his theory as to why the compatibility dilemma exists. What he said was, "Compaq hasn't the engineering wizardry of IBM."

I will not deny that Compaq does not possess the depth of IBM's computer knowledge. But what is important to remember is that we are talking about the *PC* market here. This is the same market in which IBM bought a chip from Intel and told Bill Gates to write an OS to make it work (a slightly oversimplified explanation). Thus was born the IBM Personal Computer. There were better machines out there at the time, but not one with such a vast amount of software written for it. Then, when everyone started to do a better job than IBM with AT-bus-based computers (for example, Compaq), Big Blue abandoned that platform for another that has yet to prove itself as better. And Compaq went on to spearhead the EISA movement.

The proliferation of packages written specifically for the 386 has already split the PC market into two distinct segments.

The real issue here is the ability to enforce a standard, and in this market no company seems to be great enough to do that anymore. IBM set a standard with its original PC not because of its engineering wizardry but because of its marketing wizardry. It built a rather unrevolutionary PC and coupled it with a "follow us or else" attitude, and we bought it. That may never happen again.

Earl H. Browning III
Richardson, Texas

ACCOUNTING FOR SUITABILITY

As soon as I received my September 26, 1989, issue of *PC Magazine,* I quickly turned to your review of LAN-based accounting systems ("LAN Accounting Software: Up to Speed on the PC Platform"). As a financial systems consultant who specializes in helping large businesses decentralize their accounting systems, I was eager to read your reviews of the top accounting software products.

I thought you were headed in the right direction when the article began by discussing "enterprise accounting." It has been our experience that selecting ac-

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Tri▶Star 386 Systems

Standard Features:

- Intel 20MHz or 25MHz 80386 Processor
- **1MB RAM Expandable to 8MB on System Board**
- Page Interleaved Memory Architecture
- **Advanced Chips & Technology NEAT Chip Set**
- 384K Shadow RAM Caching for BIOS
- **1.2MB 5.25-inch Floppy Disk Drive**
- **1.44MB 3.5-inch Floppy Disk Drive**
- **65MB-22ms Fast Access Hard Drive**
- 1:1 Interleave 16-Bit Controller
- Fast 800 KB/sec Data Transfer Rate
- **14" Seiko 1430 SVGA/8514A Monitor**
- **ATI VGA Wonder Card 16-Bit with 512K**
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- 2 Serial, 1 Parallel, & 1 Game Port
- Fully DOS, Unix, & OS/2 Compatible

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65MB Hard Drive **$2895**

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65MB Hard Drive **$3095**

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150MB EDSI Hard Drive Upgrade $695

Concorde Graphics Workstation

Standard Features:

- Intel 20MHz or 25MHz 80386 Processor
- **1MB RAM Expandable to 8MB on System Board**
- Page Interleaved Memory Architecture
- **Advanced Chips & Technology NEAT Chip Set**
- 384K Shadow RAM Caching for BIOS
- **1.2MB 5.25-inch Floppy Disk Drive**
- **1.44MB 3.5-inch Floppy Disk Drive**
- **65MB-22ms Fast Access Hard Drive**
- 1:1 Interleave 16-Bit Controller
- Fast 800 KB/sec Data Transfer Rate
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- **ATI VGA Wonder Card 16-Bit with 512K**
- Quality 101 Key Enhanced Keyboard
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- Fully DOS, Unix, & OS/2 Compatible

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65MB Hard Drive **$2995**

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Standard Features:

- Intel 20MHz, 25MHz, or 33MHz 80386 Processor
- **64K Static RAM Cache @ 25 Nano's**
- Eight Layer Design Made in U.S.A.
- **1MB/4MB of 32-Bit RAM / Up to 8MB on Board**
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- **1.44MB 3.5-inch Floppy Disk Drive**
- **65MB-22ms Fast Access Hard Drive**
- 1:1 Interleave 16-Bit Controller
- Fast 800 KB/sec Data Transfer Rate
- **14" Seiko 1430 SVGA/8514A Monitor**
- **ATI VGA Wonder Card 16-Bit with 512K**
- Quality 101 Key Enhanced Keyboard
- 2 Serial, 1 Parallel, & 1 Game Port
- Desk Side Vertical System Enclosure
- 80387 & Weitek Co-Processor Support
- Fully DOS, Unix, & OS/2 Compatible

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65MB Hard Drive **$3395**

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How to plan your LAN.

You'll need a pencil.

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It's pretty much that simple.

With one call you can plan on substantial savings over the big name computers which, despite high clock rates and even higher price tags, are not really optimized for networking.

And you can plan on 100 percent compatibility with all versions of Novell's NetWare,® because Samsung's LAN hardware was co-designed by Novell. Just like the label says.

THE TESTING WENT IN BEFORE THE LABEL WENT ON.

Both the Samsung 386AE and PCterminal/286 have been tested exhaustively and certified by Novell for compatibility with all popular networking hardware and software products. As a matter of fact, Samsung's 386AE is one of 3 fileservers certified by Novell to run NetWare 386.

For example, engineers at Novell successfully tested the PCterminal/286 LAN Workstation in no less than 1200 different network configurations... with 50 units running at once! That's a claim no other computer manufacturer can make.

NETWORKING VS. NOTWORKING.

What's the difference? Take our 386AE Fileserver, for instance. It includes Novell's Advanced BIOS, and eight expansion slots to accommodate multiple network interface cards and disk controllers. Plus an oversize power supply capable of driving dual high capacity hard disks and tape

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back-up system. Plus 4 megabytes of main memory for disk caching.

Then there's Samsung's PCterminal/286 Diskless Workstation which includes a built-in Ethernet interface and Novell's Remote Boot EPROM.

And not to be overlooked is our 16-bit SE2100 Ethernet Interface Card which provides up to twice the throughput for the price of an 8-bit card.

THE SAMSUNG COMMITMENT.

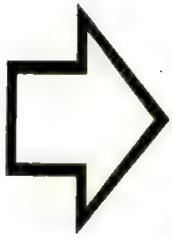
With 4 million monitors and half a million PC and LAN computers sold in 1988 alone, it's clear that Samsung has made a serious commitment to the marketplace. In all, Samsung offers no less than nine different PC and LAN computer models with seventeen color and monochrome monitors! And, as a 31-billion dollar international corporation, Samsung has the resources to provide continuous support for its customers.

So why not begin your network planning today? For the name of the Samsung reseller nearest you, write:
SAMSUNG, 3655 North First Street, San Jose, CA 95134, or call **1-800-446-0262.**

SAMSUNG

CIRCLE 156 ON READER SERVICE CARD

ClipArt from A to Z.



A is for Arrow

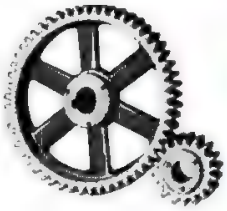
B is for Baseball

C is for Cartoons

D is for Dinosaur

E is for Easter

F is for Flags



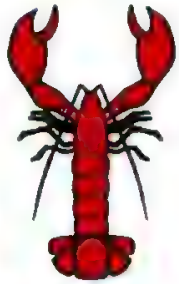
G is for Gears

H is for Heart

I is for Ice Cream

J is for Jet

K is for King



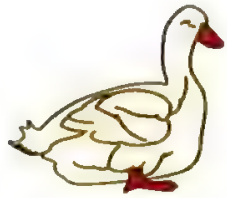
L is for Lobster

M is for Motorcycle

N is for Nutcracker

O is for Olympics

P is for Penguin

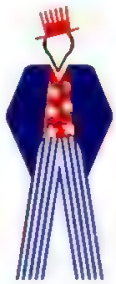


Q is for Quack

R is for Reagan

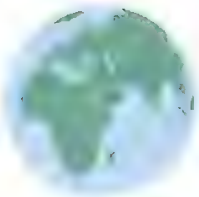
S is for Santa

T is for Texas



U is for Uncle Sam

V is for Valentine



W is for World

X is for X-ray

Y is for Yacht

Z is for Zip Code

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Letters

counting software for departments of large companies revolves around the management-reporting capabilities of the package rather than the financial reporting.

However, I was disappointed that you did not follow through with this approach. The individual product reviews did not discuss much beyond the packages' standard list of features. And nowhere in the review of each package did you give any basis for your rating on the "Suitability to Task" chart. I would like to have seen more emphasis on the reporting capabilities of each package, for this important feature should have provided the basis for your ratings.

Deborah A. Richman
South Norwalk, Connecticut

ONE DISK, MANY BACKUPS

Your recent reviews of backup programs ("Backup Software: For the Moment After," *PC Magazine*, August 1989) lack one critical item that should be in your features table: namely, the question of whether the program can append backup files to a previous backup disk. I presently use "lowly" DOS backup and need only about 10 disks for two months of incremental backup. I *don't* want to have to use 25 disks just because a so-called advanced backup program forces me to use a fresh disk for each incremental backup.

Brian Peck
Milwaukee, Wisconsin

While the feature in question was indeed absent from the features table, we made a point of noting in the reviews whether or not a program allows you to append to disks used in previous backups. *Fastback Plus* and *Intelligent Backup*—our two Editor's Choices—and others (including *Bakup* and *BackEZ*) offer this capability.

STAR TECH

I left the PC retail channel in favor of working for a VAR about a year and a half ago, owing to many of the reasons outlined in your recent series of columns on computer dealers (*PC Magazine*, September 12, 1989). Regardless of these reasons, my two years' experience working at a large retail store as a technician gave me a closer and different vantage point than you might have of the situation.

UTILITIES CORRECTION

The 1STCLASS utility in the November 14, 1989, issue of *PC Magazine* has caused some confusion with the *1st-CLASS Software* product produced by 1st-CLASS Expert Systems Inc. of One Longfellow Center, 526 Boston Post Rd., 150 East, Wayland, MA 01778. We apologize for the unintentional confusion and to make sure that further confusion does not arise we have changed the name of our 1STCLASS utility to EMMA.

My biggest objection to the columns that appeared in *PC Magazine* is the lack of attention that was given to the role of the technical departments of retailers. True, these departments are oftentimes the havens of "sleepy technicians," but when tech departments are made the dynamic sales tools they can be, great things will happen.

During my retail experience, I saw the top salespeople use my abilities as an asset, not just a service. These salespeople took me with them on their sales calls and helped me to realize how much I could do for our clients. One salesperson's favorite tactic was to ask me, in front of the client as I stripped his machine, "Why did Brand X computer maker do that?" Not only did this make my presence and knowledge apparent to the client before his file server went down, it made him more comfortable purchasing his systems from us.

Technical departments need to be involved in the sales effort as an active resource, not a last-ditch backup.

W. Talley Fritsch
Houston, Texas

CORRECTIONS & AMPLIFICATIONS

The Prodigy Interactive Service (After Hours, PC Magazine, October 17, 1989) does not run in CGA mode, as was reported. Rather, it runs in an EGA mode of 320 by 200 pixels with 16 colors.

HOW TO WRITE TO PC MAGAZINE

Send letters to *PC Magazine*, One Park Avenue, New York, NY 10016, or upload to PC MagNet (see the "By Modem" sidebar in the Utilities column for access information). All letters become the property of *PC Magazine* and are subject to editing. ■

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The Swan 386/33 easily manages today's most power-hungry applications such as CAD/CAM/CAE. It's blazing 33MHz speed will especially benefit multi-user and multi-tasking networks running under UNIX® and XENIX®. And because it comes in a vertical case, you can have all this power at your fingertips without taking up all your desk space.

To provide the expandability required for network fileservers and multi-tasking systems, this Swan is expandable to 16MB of memory. In addition, the Swan 386/33 also offers an access socket for either the Intel™ or Weitek 3167 math coprocessor.

Like all Swan products, the 386/33 is competitively priced and backed by Swan's unsurpassed customer support services. No wonder the Swan 386/33 is the acknowledged value-leader in the field.

Swan 386/20D

"Tussey's Swan 386/20 flies."
— Computer Shopper, April 1989

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w/ 80MB (28ms) & 1:1 Interleave	$2749	$2798	$2948	$3248
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Vertical Case Option for 386/20 w/230W power supply add $300

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— PC Week, Apr. 10, 1989

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w/ 48MB (28ms) & 1:1 Interleave	$1899	$1948	$2098	$2398
w/ 80MB (28ms) & 1:1 Interleave	$2249	$2298	$2448	$2748
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— PC Magazine, Sept. 12, 1989

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Speed (MHz)	33/8	20/8	16/8	12.5/6.25	10/4.77
BIOS	Phoenix	Phoenix	Phoenix	Phoenix	Phoenix
Norton SI Rating v 4.0	41.8	22.0	17.6	12.3	2.1
Standard Memory	1MB	1MB	1MB	512k	640k
Shadow BIOS	Yes	384k	Yes	Yes	—
Memory Upgrades	2/4/8/16MB	2/4/8/16MB	2/3.5/6.5MB	640K/1.2/3.5MB	—
Coprocessor Support	80387 or 3167	80287 or 80387	80387SX	80287	8087
Expansion Slots 32-bit	1	1	—	—	—
Expansion Slots 16-bit	5	4	6	6	—
Expansion Slots 8-bit	2	3	2	2	8
Dual HD/FD Controller	Yes	Yes	Yes	Yes	w/ HD systems
5.25" Floppy Drive	Standard	Your Choice	Your Choice	Your Choice	Standard
3.5" Floppy Drive	Standard				Optional
Device Bays (1 speed, internal)	6 Exp	3 Exp/2 Int	3 Exp/1 Int	3 Exp/2 Int	2 Exp/2 Int
Serial Ports	2	2	1	1	1
Additional I/O Ports	1 Parallel	1 Parallel	1 Parallel	1 Parallel	1 Par/1 Game
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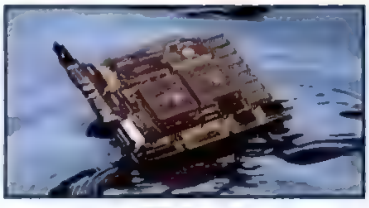

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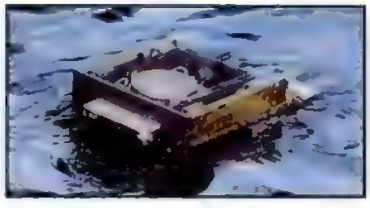

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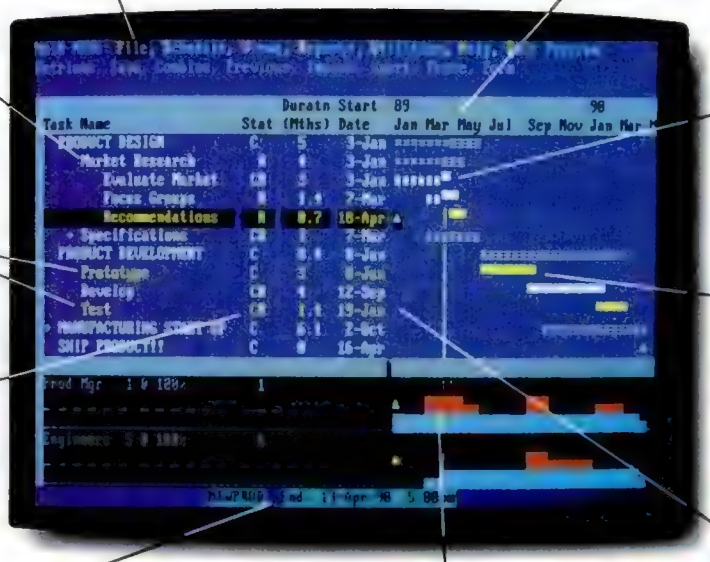

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by Lori Grunin

Advisor

TRUE-BLUE BIOS UPGRADE

I have one of the original IBM PCs. When I tried to install several new peripherals on my machine, it refused to boot. Suspecting that the old BIOS was the culprit, I placed a call to the IBM Product Center and was told that IBM no longer sells BIOS upgrades. I haven't been able to locate a company that does.

Can you locate the chips? If not, what are my alternatives?

Gerald Rice
Hoffman Estates, Illinois

The magic date on the IBM PC BIOS is October 27, 1982. BIOSs previous to that are *nonextensible*, meaning that individual devices can't patch the code to the BIOS that tells it how to address and manipulate the device. BIOSs from October 27, 1982, to the present are extensible.

In order to find the date of your BIOS, use DOS's DEBUG program by typing D F000:FFF0 at the hyphen prompt. The rightmost information is the date of your BIOS.

If you find that you do need the upgrade, it can be purchased from Mentor Electronics ($40, plus shipping and handling; 7560 Tylor Blvd., Suite E, Mentor, OH 44060; (216) 951-1884) and from Komputerwerk ($50, plus shipping and handling; 851 Parkview Blvd., Pittsburgh, PA 15215; (800) 423-3400, (412) 782-0384). Your problem may also stem from an IRQ conflict between two or more plug-in cards or from an inadequate power supply.

9-PIN POSTSCRIPT

I am interested in software that will allow me to send PostScript output (from *PageMaker*) to my 9-pin dot matrix printer. Are there any packages that do this? I also have access to an 18-pin color printer, and I would like to know if any PostScript interpreters will also allow color printing.

Marc Kramer
Waterloo, Iowa

- TRUE-BLUE BIOS UPGRADE: When to change your PC's BIOS and where to find a replacement.
- 9-PIN POSTSCRIPT: Getting PostScript output from your dot matrix printer.
- WHICH MUSIC CARD?: Choosing a board for game playing and composing.

As long as you have an 80286- or 80386-based machine, The Laser Connection's *UltraScript PC* ($195; 7851 Schillinger Park West, Mobile, AL 36608; (800) 523-2696, (205) 633-7223) will let your dot matrix printer output good-quality PostScript. Of all the software interpreters we've tested, *UltraScript PC* is the fastest at printing PostScript graphics, and it prints text only a bit more slowly than LaserGo's *GoScript*, Version 2.2 ($195 with 13 fonts, $395 with 35 fonts; 9235 Trade Pl., Suite A, San Diego, CA 92126; (619) 530-2400). *UltraScript PC* comes with 25 typefaces, and a $445 version, *UltraScript PC Plus*, offers 22 additional typefaces.

One last option is *Freedom of Press*, Version 2.1, a $495 interpreter from Custom Applications (5 Middlesex Technology Center, 900 Middlesex Tpke., Billerica, MA 01821; (800) 873-4367, (508) 667-8585) that has 35 typefaces.

UltraScript PC can print from within many applications (as long as the application does not write directly to the printer port), giving it a strong edge over the other two packages, which force you to print the file to disk first. On the other hand, *Freedom of Press* and *GoScript* run on 808*x*-based machines.

Freedom of Press needs 512K of expanded memory, and while *UltraScript PC* and *GoScript* can function without EMS memory, *UltraScript PC* needs at least 800K of extended memory to print from within an application. In addition, *GoScript* requires a minimum of 1MB of expanded memory if *any* EMS memory is present.

If you also want to use these packages with a laser printer, all three require 1MB of expansion memory in the printer. Extended memory increases output speed perceptibly for all the packages.

Although we haven't yet tested their color capabilities, *Freedom of Press* and *UltraScript PC*, Version 2.0 (which should be shipping by the time you read this), can produce color PostScript output. *Freedom of Press* supports a larger number of color output devices (including film recorders) than *UltraScript PC*, which currently has only HP PaintJet and Epson 2550 drivers. It is unfortunate for you, however, that neither package offers drivers for 18-pin color printers—only for 24-pin models.

I don't have room to list the supported printers for each of the packages, but you can find that information in our review of *UltraScript PC* (First Looks, *PC Magazine*, September 26, 1989), as well as in the reviews of *Freedom of Press* and *GoScript* that appear in "Getting PostScript the Cheap Way," a sidebar to "Add-in Boards for the HP LaserJet: Post-Purchase PostScript" (*PC Magazine*, April 11, 1989, page 218). Although your printers may not be directly supported by the packages, you're in business as long as they can emulate one of the compatible printers listed.

WHICH MUSIC CARD?

I own a 286-based system and am interested in music software and hardware for my PC. I own *King's Quest IV: The Perils of Rosella* (Sierra On-line), and it supports three cards: the IBM Music Feature, the Ad Lib Music Card, and the Roland MT-32. The cards offer 8, 11, and 32 voices, re-

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spectively. In addition to using the card with games, I'd also like to use the computer to write music. Which should I get?

Scott Lewis
Candler, North Carolina

When it comes to games, the sound you get from a given card depends not only on the number of voices it produces but also on how much effort the game developer has put into the sound effects for the card. For instance, Sierra has concentrated on making beautiful music with Roland's MT-32; the Ad Lib Music Card ($179.95; Ad Lib Inc., 220 Grande-Allée East, #960, Québec City, Québec, Canada G1R 2J1) and IBM Music Feature ($495; IBM Corp. (contact your nearest authorized IBM dealer); (800) IBM-2468) output aren't as good as they could be.

Some games, on the other hand, generate quite acceptable music from the Ad Lib's 11 voices. Access Software has even done amazing things with the PC's speaker using digitized music and sound effects. Right now, most games support the Ad Lib card, but support of the MT-32 is growing thanks to companies such as Activision (Mediagenics) and Lucasfilm.

If the games you like to play support the Roland, and if you're a serious musician who won't mind parting with a serious amount of money, then neither the IBM Music Feature nor the Ad Lib card can seriously compete with the MT-32, the only card of the three that is truly compatible with MIDI (Musical Instrument Digital Interface) protocols.

Actually, the MT-32 is just a sound module; you also need to buy the MPU-IPC, the MIDI interface that goes into your machine. Roland will also be offering a unit similar to the MT-32 called the CM-32L, which has 32 additional sound effects but lacks the external controls of the MT-32 (MT-32, $695; CM-32L, $650; MPU-IPC, $170; MPU-IMC (for Micro Channel), $350; RolandCorp U.S., 7200 Dominion Circle, Los Angeles, CA 90040; (213) 685-5141). People tend to refer to the *combination* as the MT-32. By the time you read this, Roland should also have released the LAPC-I ($595), which combines the functions of the CM-32L/MT-32 and the MPU-IPC on one board.

You can write music with the IBM Music Feature, but you're locked into using IBM's software, since the card uses protocols different from those of the MPU-401 MIDI standard, developed by Roland. Similarly, the Ad Lib board is proprietary and won't support MIDI-compatible music packages. If you get the MT-32 setup, you'll need to buy third-party sequencing software.

If terms like *MIDI* and *sequencing* are new to you, then do a little reading before you buy; the equipment is expensive and the subject complex. One place to start is "A MIDI Musical Offering" in the November 29, 1988, issue of *PC Magazine*, in which we reviewed nine different sequencing software packages. There are several accompanying articles that can help you get a handle on the subject.

ASK THE ADVISOR

Send your questions to Advisor, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see the "By Modem" sidebar in the Utilities column for access information). Please specify your equipment. ■

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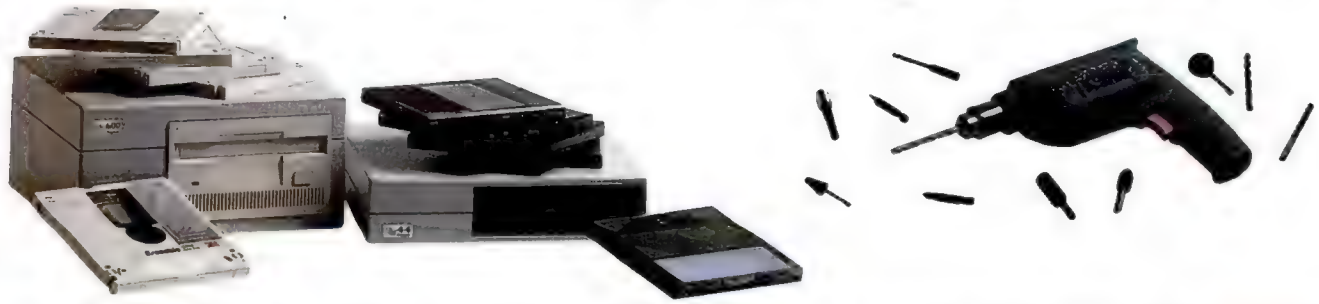

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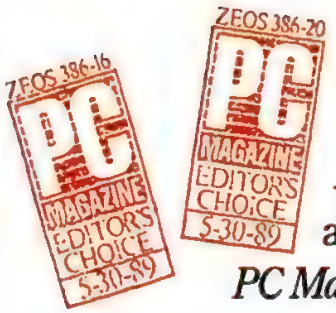

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PC Magazine, May 30, 1989

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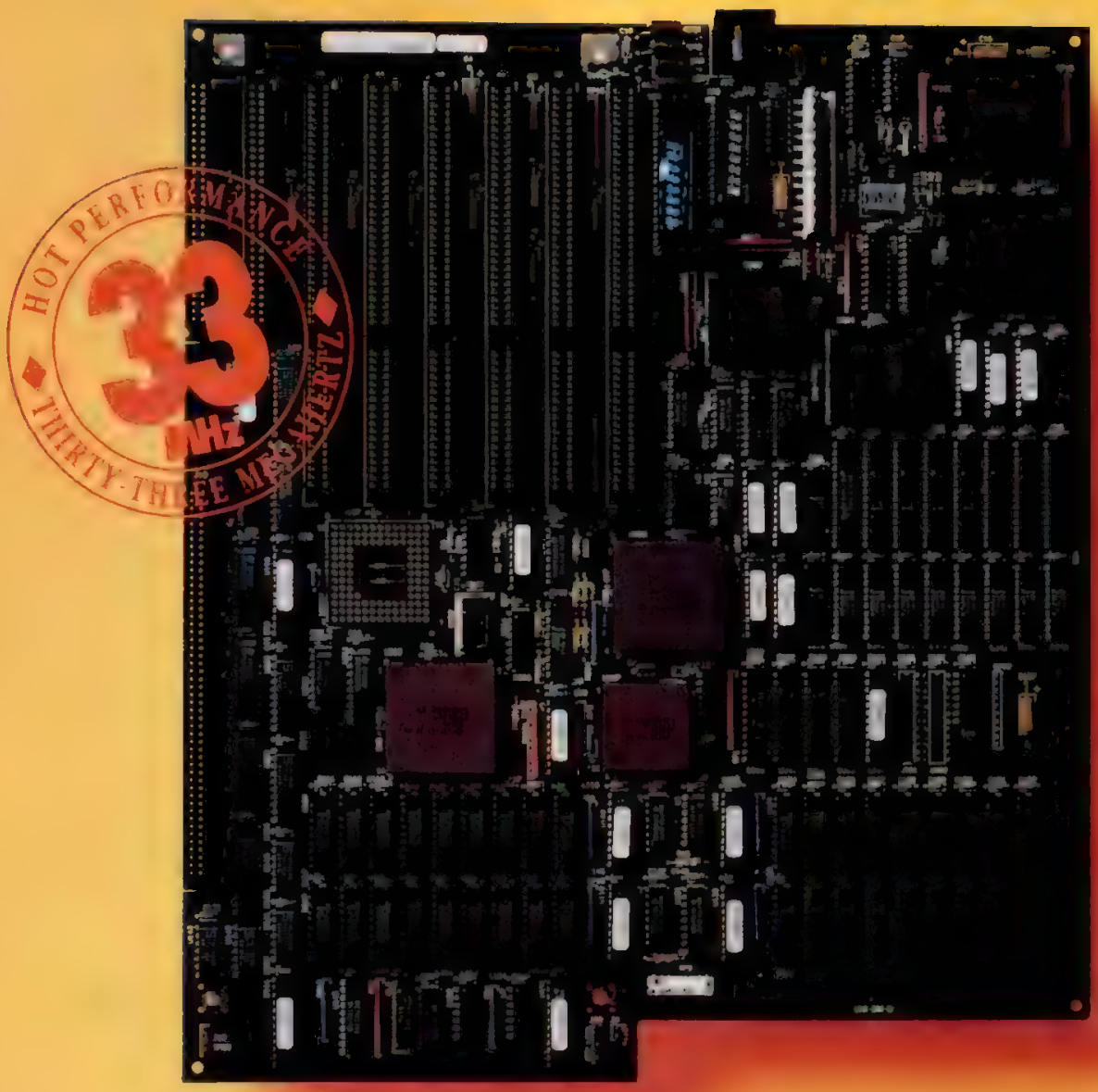

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First Looks

Hands-on Reviews of the Latest Products

Feature-Packed Quattro Pro Employs Ambitious Memory Management Technique, Runs in 512K

HANDS ON
by Craig Stinson

Two years ago, when its name still stood for nifty and inexpensive software, Borland International brought out *Quattro*, a spreadsheet offering almost-perfect *Lotus 1-2-3* compatibility, a superior macro debugger, a host of innovative convenience features, and freedom from copy protection—all at a street price of about $150. *Quattro* got good reviews, but it didn't move much of the corporate world off its *1-2-3* perch.

Borland's style has changed since then. This year, the company is taking another shot at the spreadsheet market with *Quattro Pro*, a stronger and much more ambitious piece of work. Where the original *Quattro* was bargain-priced and only somewhat more feature-rich than *1-2-3*, *Quattro Pro* is priced on a par with Release 2.2 (as well as *Microsoft Excel* and *SuperCalc*) and comes with a very impressive set of features.

Like *Microsoft Word*, *Quattro Pro* runs in either character or graphics mode. The former is quicker, while the latter offers the advantages of graphs embedded in the worksheet and on-screen print previewing. You can toggle between the two modes at any time.

Either way, you get a windowing interface that can be plied with keyboard or mouse.

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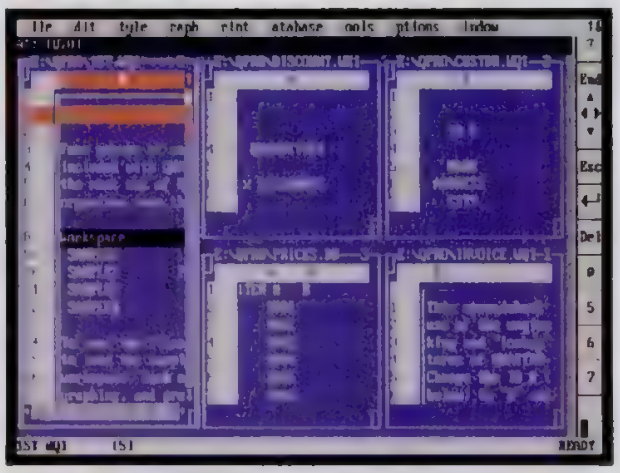

Quattro Pro's worksheets can be tiled, stacked, or lapped. The interface includes icons, scroll bars, and other GUI-style paraphernalia.

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Flexible personal-data management under *Windows* 38

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Tiny, 1-pound PC offers most of the power of DOS 43

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Switch-It
Switches between applications, eases RAM-cram 46

Smalltalk/V PM Provides Object-Oriented Programming Environment for PM

HANDS ON
by Ray Duncan

Over the last couple of years, object-oriented programming languages (OOPLs) have emerged from the musty back rooms of computer science to become the darlings of the media. Object-oriented jargon has become a fearsome marketing weapon: our mailboxes are filled with advertisements for crash courses and seminars on object-oriented software design, and the pioneers of object-oriented programming are drawing standing-room-only crowds at events such as Software Development '89. Microsoft and Borland have grafted object-oriented extensions into their Pascal compilers, and Apple has announced that programmers who ignore the object-oriented handwriting on the wall will have no place in the Macintosh's future.

With so much smoke being generated, any programmer might speculate that there must be some fire. The trick is to determine whether or not it's time to make a major change in programming tools. In this respect,

CONTINUES ON PAGE 34

Smalltalk/V PM

CONTINUED FROM PAGE 33

Digitalk's new *Smalltalk/V PM* for the OS/2 Presentation Manager is the right product in the right place at the right time.

Smalltalk is one of the oldest and purest of the object-oriented languages. It was developed in the early 1970s at Xerox's legendary Palo Alto Research Center (PARC) by equally legendary luminaries such as Alan Kay and Adele Goldberg. Digitalk has been producing high-quality, low-priced *Smalltalk/V* implementations for DOS and the Macintosh since 1985. The marriage of Digitalk's software technology with OS/2's multitasking, interprocess communications, virtual memory, and the versatile Presentation Manager graphics engine brings *Smalltalk* within the reach of nearly every programmer, where its inventors imagined it would be.

Object-oriented languages like *Smalltalk* are a good match for operating systems with graphical user interfaces (GUIs) because they were designed to help programmers manage complexity—and it's hard to imagine complexity more in need of management than the OS/2 Presentation Manager, with its 900-odd different application program interface (API) functions. Furthermore, the fundamental constructs in OOPLs map neatly onto the events, messages, windows, and subclassing found in typical GUIs. The *Smalltalk* environment takes care of the gory details of screen, keyboard, and mouse management, freeing the programmer to concentrate on the essential elements of his or her application.

As you can probably tell by now, it's difficult for me to contain my enthusiasm for *Smalltalk/V PM*. This is a robust piece of software, easy to install and use, with lots of elegant touches that make a programmer's life more bearable. The interactive *Smalltalk* environment lends itself to rapid prototyping, and the traditional OOPL emphasis on code sharing and reusability is a tremendous boost to programmer productivity.

The built-in debugging facilities make it easy to track down and eliminate glitches in your source code, and the *Smalltalk/V* interpreter/compiler appears to be virtually crashproof. The documentation is clearly written, complete, and—quite unusual—interesting to read, with programming examples that go far beyond the trivial code snippets found in language manuals for more-traditional compilers.

One of the more interesting advantages of using *Smalltalk/V* is the cross-platform portability it provides. A well-behaved *Smalltalk* application program can be compiled and executed equally well on either the Macintosh or Presentation Manager implementations of *Smalltalk*; better yet, the differences in the two GUIs are handled within the *Smalltalk* kernel in such a way that the program will have the look and feel of a Macintosh application on the Macintosh and of a proper PM application under OS/2.

For programmers who don't care a fig for cross-platform compatibility, *Smalltalk/V PM* also fully supports the PM's dynamic link library (DLL), dynamic data exchange (DDE), and graphics metafile facilities. *Smalltalk/V PM* even allows direct calls on Presentation Manager entry points. Thus, it is an excellent probe and exploratory tool for developers who want to familiarize themselves with the Presentation Manager's capabilities, regardless of their preferences in programming languages.

A few warnings should be heeded before you rush out to buy a copy of *Smalltalk* expecting it to completely change your life and solve all your PM problems. First, *Smalltalk* has an insatiable appetite for machine resources. The *Smalltalk/V PM* interpreter and its dynamic link libraries and other files will demand about 2MB of your fixed disk, and I wouldn't recommend even trying to use the language on a system with less than 4MB of RAM; the amount of swapping that goes on with 4MB is very noticeable, and on a machine with only 2MB, the disk thrashing is definitely intolerable.

The overall quality of your video display is a crucial element too; VGA is a minimum requirement for *Smalltalk* development, and serious *Smalltalk* programmers will probably want an 8514 so that they can keep more windows in sight simultaneously.

Next, and perhaps most important, *Smalltalk* requires a fundamental shift in viewpoint for programmers accustomed to

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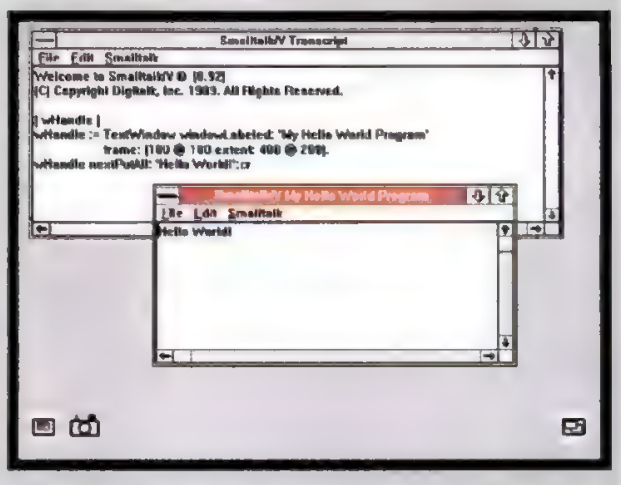
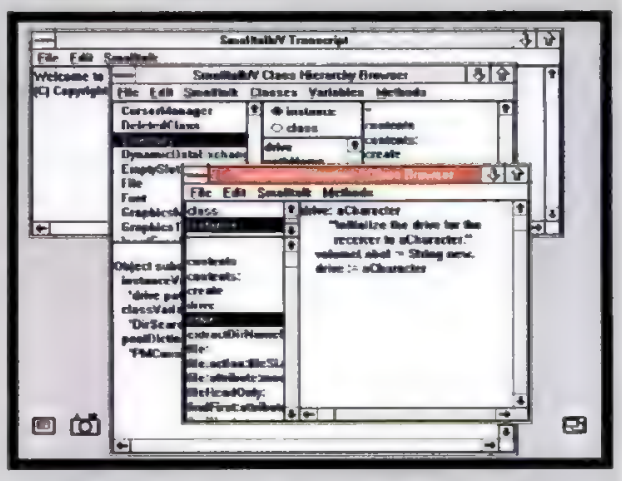


As this simple program illustrates, four lines written with *Smalltalk/V PM* can accomplish the same work as a full page of inscrutable C code.



With *Smalltalk/V PM*, small pieces of code can be tested interactively and built incrementally into complete applications. Most programming is done within the context of "browser" utilities, which allow *Smalltalk* "objects" and "methods" to be added, inspected, or changed.

FACT FILE

Smalltalk/V PM
Digitalk Inc., 9841 Airport Blvd., Los Angeles, CA 90045; (800) 922-8255, (213) 645-1082.
List Price: $499.95.
Requires: 80286- or 80386-based PC/AT, PS/2, or compatible; OS/2 1.1 or 1.2; 4MB or more of RAM recommended
In Short: A powerful, object-oriented programming language for interactive exploration of OS/2 Presentation Manager facilities and rapid development of OS/2 applications.

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Smalltalk/V PM

CONTINUED FROM PAGE 34

traditional procedural languages such as C and Pascal. The OOPL promoters who talk about paradigm shifts aren't just mouthing buzzwords; developing object-oriented software involves radically different approaches to application analysis and design, and it's likely that you'll flail around for quite a while before you really reap much in the way of productivity benefits.

The interactive *Smalltalk* environment, with the source code for nearly the entire system online at all times, can also be a double-edged sword; on the one hand it's great that you can customize the *Smalltalk* system to suit almost any need, but it's also possible (even easy) to modify fundamental *Smalltalk* objects in such a way that the entire system quits working altogether.

Finally, the highly dispersed nature of *Smalltalk* programs and the seamless interface between the *Smalltalk* interpreter/compiler and the application program can make source-code control and documentation a somewhat problematic proposition.

These caveats aside, any programmer interested in object-oriented languages or the OS/2 Presentation Manager shouldn't hesitate to consider *Smalltalk/V PM*. ■

Quattro Pro

CONTINUED FROM PAGE 33

Windows can be sized and moved individually, or they can be stacked or tiled via a menu command. Mouse users can click sidebar icons for commonplace commands, can specify worksheet ranges with a wave of the hand (ranges can be selected either before the command is issued, as in *Excel*, or after, as in most other spreadsheet programs), and can navigate via scroll bar.

You can keep up to 32 worksheets in memory and write formulas that reference external cells in both resident and disk- or server-bound files. External-reference formulas can use wildcards to consolidate values from a particular address in many worksheets at once. *Quattro Pro* doesn't have a multipage 3-D capability in the style of *1-2-3*, Release 3, but a workspace command lets you save constellations of worksheets as though they were separate pages of a single file.

Quattro Pro needs no publishing add-in. It has commands for drawing lines (single, double, and thick), applying shading (gray and black), and creating seven styles of bullets. It supports 37 PostScript fonts and all HP cartridges, along with the same set of Hershey fonts offered in *Quattro I*.

Most impressive, it comes with Bitstream outlines for Dutch and Swiss (Times and Helvetica look-alikes) and an integrated installer that lets you add any other outlines from the Bitstream font library.

Quattro Pro builds some fonts at installation time (if you choose) and creates others on the fly as needed, storing the bitmaps on your hard disk. Sizes range from 8 to 72 points; styles include the usual roman, italic, bold, and bold italic; and any font can be printed in either portrait or landscape orientation.

A print previewer lets you check the aesthetics of your worksheet without wasting time and paper. The cursor keys move a viewing window around the page in preview mode, and simple commands let you zoom to 400 percent for detailed inspection.

New graph types include high-low and text. New options include the ability to use two y-axes and select log-log or semi-log scaling. Graphs can be planted "live" anywhere on the spreadsheet, providing immediate visual response to numeric changes.

In addition to these graphical improvements, *Quattro Pro* comes with a built-in drawing program. It's not particularly

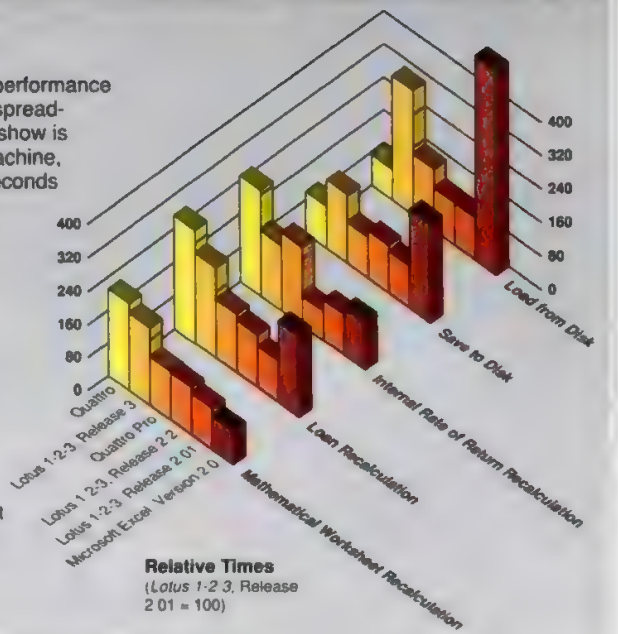
CONTINUES ON PAGE 36

PERFORMANCE TESTS: QUATTRO PRO

Our tests show that *Quattro Pro*'s performance puts it in the middle of the pack of spreadsheets. What the test results don't show is that, on a 16-MHz 80386-based machine, the program takes more than 13 seconds to load, 7 seconds to quit, about 5 seconds to draw a graph, and as long as 15 seconds to switch from text mode to graphics mode—all noticeably slower times than the competition's.

Mathematical Worksheet Recalculation reports the time taken to calculate a *Lotus 1-2-3* 2.01 worksheet with 1,950 mathematical functions and 494 text cells. Lower times indicate more-efficient implementation of standard spreadsheet functions.

The **Loan Recalculation** test worksheet calculates the monthly payment and displays the amortization schedule for a ten-year mortgage based on any given loan principal. This test is a typical spreadsheet application.



Relative Times
(*Lotus 1-2-3*, Release 2.01 = 100)

Internal Rate of Return Recalculation tests the Net Present Value and Internal Rate of Return functions. These computation-intensive formulas indicate the efficiency of a program's calculation and Internal Rate of Return algorithms.

The **Save to Disk** test measures how long it takes the spreadsheet program to save the Mathematical Worksheet Recalculation test file to disk, using the product's native file format.

The **Load from Disk** test measures how long it takes the spreadsheet program to read the Mathematical Worksheet Recalculation test file from disk, using the product's native file format.

Performance Times (Times given in seconds)	Mathematical Worksheet Recalculation	Loan Recalculation	Internal Rate of Return Recalculation	Save to Disk	Load from Disk
Quattro	126.57	4.12	6.12	3.71	4.43
Lotus 1-2-3, Release 3	113.17	3.31	3.80	6.13	18.07
Quattro Pro	70.35	2.17	4.57	3.65	8.82
Lotus 1-2-3, Release 2.2	68.43	1.96	1.73	4.27	6.05
Lotus 1-2-3, Release 2.01	59.83	1.52	2.43	3.75	6.02
Microsoft Excel, Version 2.0	48.98	3.02	2.88	9.85	29.51

Quattro Pro

CONTINUED FROM PAGE 35

easy to use (among other shortcomings, it lacks an erase command), and it pretty much requires a mouse. But once you've mastered it, you can dress up your graphs in all sorts of ways. You can add arrows and floating text; move and stretch objects; and deploy ovals, rectangles, and polygons. A clipboard lets you cut and paste objects between graphs; you can't use it to import third-party clip art, but you can take advantage of a small library of images furnished by Borland.

Also included is a slide-show command. To use it, you just create a two-column range listing the names of graphs and the number of seconds you want each displayed; a zero value keeps an image on-screen until you press a key. Graphs may also be output in the .CGM file format.

Like *Microsoft Excel*, *Quattro Pro* offers a visual menu of available graph types.

In graphics mode, *Quattro Pro* lets you select graph colors from a palette. In text mode, the program displays a list of colors instead.

As for data management, *Quattro Pro* has the ability to query external database files from *dBASE II*, *III*, *III Plus*, and *IV*, as well as from Borland's own *Reflex* and *Paradox*. You can't send commands to the external program (as users of *1-2-3*, Release 3, may be able to do, given an appropriate DataLens driver), but you can easily import and analyze a filtered selection of records from a file that would be too large to import in toto.

Other attractions include interruptible recalc, commentable formulas and values, a linear programming command, an excellent file manager (it appears to be as good as some standalone shells), a built-in file compressor (*SQZ! Plus*), a removable undo system, a macro recorder, and the ability to substitute a *1-2-3* menu tree for the native *Quattro* item.

What's most remarkable is the fact that this wealth of features is available on any machine with 512K or more, from the lowly XT on up. The smoke and mirrors here are a technology Borland calls VROOMM (Virtual Real-time Object-Oriented Memory Management). With VROOMM, *Quattro Pro* uses many small code overlays instead of a few large ones, and it decides while you're using the program which chunks of code you need and which you can do without.

As your worksheets get larger, *Quattro Pro* removes more of itself and does more swapping. But since the overlays are tiny (most are on the order of 2K to 4K), you may not notice much delay. And even if you do, you'll probably find it preferable to wait a moment now and again than to have, say, the entire graphics module bounced out of the program (as happens in some other spreadsheets) for lack of RAM.

In tests for this review, *Quattro Pro* proved itself an able performer—much faster than *Quattro I* and nearly as fast as *1-2-3*, Release 2.2. But on some activities not measured by our performance tests, *Quattro Pro* is maddeningly slow. On my 16-MHz 386 machine, the program took more than 13 seconds to load (twice as long as Release 2.2 of *1-2-3* with *Allways* auto-attached, and 2 seconds longer than Release 3) and 7 seconds to quit.

Drawing a simple graph, a process that happens almost instantaneously in *1-2-3*, took about 5 seconds with *Quattro Pro*, and switching from text mode to graphics mode sometimes took as long as 15 seconds. None of this dead time resulted from code swapping. I put the .EXE file, the file containing all the overlays, and the menu resource file in a large RAMdisk and got the same results.

The absence of multipage three-dimensionality is also regrettable, not because it's needed for worksheet consolidation (both *Excel* and *Quattro Pro* can consolidate just fine without multiple pages), but because it simplifies cross-sectional graphing of parallel data. Certain analyses that would be a breeze in *1-2-3*, Release 3 (or *ProQube*) would be cumbersome in *Quattro Pro* because the latter doesn't let you name ranges across worksheets.

These criticisms aside, *Quattro Pro* is an extremely attractive program. It's worthy of serious consideration not just by those with limited hardware, but also by anyone who needs a strong spreadsheet with a full set of presentation features. Those who want power without leaving character-based DOS or reconfiguring their systems for a DOS extender may find *Quattro Pro* an ideal solution. ■

FACT FILE

Quattro Pro
Borland International, 1800 Green Hills Rd., Scotts Valley, CA 95066; (408) 438-8400
List Price: $495; upgrade from *Quattro I*, $79.
Requires: 512K RAM, hard disk, DOS 2.0 or later.
In Short: *Quattro Pro* offers worksheet linking, multiple files in memory, the ability to embed graphs in worksheets, a drawing package for turning graphs into presentations, a slide-show generator, Bitstream fonts in sizes from 8 to 72 points, the ability to query external database files, a mouse interface, flawless compatibility with Release 2.01 of *Lotus 1-2-3*, and more. It's surprisingly slow at some tasks, and it doesn't do multipage worksheets, but the program is otherwise very impressive.

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IBM Software an Oxymoron? Current Proves No

HANDS ON
by Barry Simon

If the mention of *IBM* and *software* in the same sentence makes you smirk, be prepared to change your mind-set. Following Xerox's example, IBM has set up a division to acquire the rights to and market third-party software. If *IBM Current*, the first program to be released under this arrangement, is any indication of the products to come, you'll have to start associating IBM software with the words *power*, *flexibility*, and *elegance*.

A personal information manager that runs under *Microsoft Windows*, *Current* organizes information as sets of linked databases. Individual databases that you set up are called *categories*. The $395 program comes with 11 predefined categories, including ToDo, Project, and Appointment, and makes it a breeze for you to define new ones and modify old ones.

Current categories are limited to 2,000 entries. Each category has records, which the program calls *items*, with a distinguished field called the *item name*. Links between categories, called *connections*, are established through these item names. *Current* also offers 13 field types, among them standard types like text (which can have fields 500 lines long), date, telephone, and currency, as well as *Windows*-specific types like check boxes and *Microsoft Excel* cells.

Current also offers a filename type. If the filename has an extension linked to a program in your WIN.INI file, then you can launch that program while viewing the *Current* item. This makes *Current* an ideal vehicle for keeping track of *Excel* spreadsheets or *Ami* documents.

The program also offers calculated fields and accepts images. Images can only be pasted from the *Windows* Clipboard rather than loaded from disk. Since you can import both bitmaps and *Windows* Metafiles, you'll be able to paste into *Current* virtually any graphic you can load into or create in another *Windows* application.

Current's date and time fields have the smarts of *Agenda*'s. If you tell *Current* that the date you wish to record is a week from Thursday, it will understand your intent and fill in the appropriate date.

Setting up connections between categories is easy. The items of one category become fields in another category, and you can make multiple assignments to a field. For example, you might have separate person and letter categories and relate them through connections listed as "letter sent to person" and "person receives letter."

When you make assignments between categories, a mouse click will bring up a list of item names from the other category. When you view a connected field with multiple assignments, you can easily scroll through them all. You can view a diagram of the interrelationships between all your categories and get a listing of all the interrelationships of a given connection.

Current shines in its reporting capabilities, which it calls *views*. The program offers five kinds of views besides the diagram of connections: simple lists, Gantt charts, calendars, books, and reports. You can filter all the views using up to four filters, with the filter options related to the field type.

A lovely touch lets you color-code calendars and Gantt charts. For example, you could open up two Gantt views of your tasks, one color-coded by project and the other by the individual responsible for the project. You can print reports that use up to four fonts, choosing the fonts from the usual *Windows* font dialog boxes. Although you can set calendar appointments for any time, the calendar display shows time in fixed (e.g., 15 minute) intervals.

The program has a form-letter module that includes a spelling checker. Since you can filter the category, you have at your disposal a powerful mail-merge engine which is marred only by the fact that each document can have only one font.

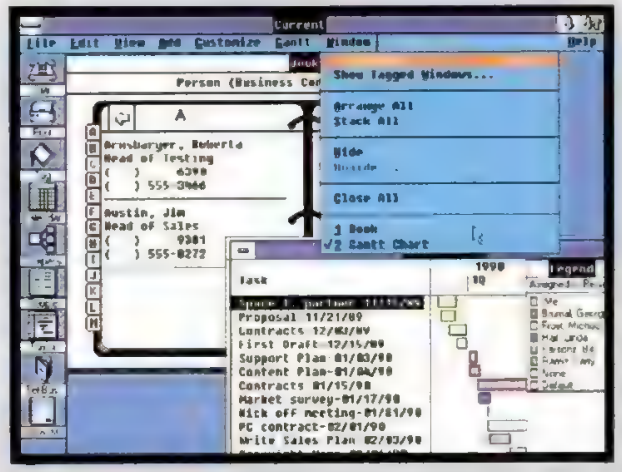
While you can export a data file to disk, *Current* does not support DDE (Dynamic Data Exchange), so transparent mail-merge to full-featured *Windows* word processors won't be possible with *Current*, as it is with Polaris's *Packrat*, another personal information manager for *Windows*. And although *Current*'s database setup features are much more flexible than those of *Packrat*, its basic time-management offerings, like alarms and recurring appointments, are more limited than those of its competitor.

Current's outliner, though useful for entering sketches for projects, is limited and not worthy of the rest of the program. Similarly, although *Current* includes a telephone dialer, it lacks intelligent handling of your home area code or Centrex exchange, as well as other amenities that *Hotline* users have gotten used to.

Current does use the *Windows* interface to good effect. An icon bar offers tools and views, and the program uses some niftily looking icons. All views, and many other objects, appear in windows that you can tag and later recall.

Current's guide to *Windows* and its printed/on-line tutorial are excellent, but its reference manual is tedious. The manual looks long and forbidding, but that's because its authors describe even the simplest actions in eight separate steps. Often the steps listed for mouse and keyboard users are identical.

IBM Current is an innovative, slick, and incredibly useful program that any *Windows* user will want. And if you don't use *Windows*, it should provide you with yet another reason to use that operating environment. ■



IBM Current can display information in a variety of forms.

FACT FILE

IBM Current, Version 1.0
IBM Desktop Software, 472 Wheelers Farms Rd., Milford, CT 06460; (800) 426-7699.
List Price: $395 (including runtime version of *Microsoft Windows*).
Requires: *Microsoft Windows*–compatible computer and display.
In Short: An intelligently designed personal information manager that is easy to use and customize and that makes use of linked databases.

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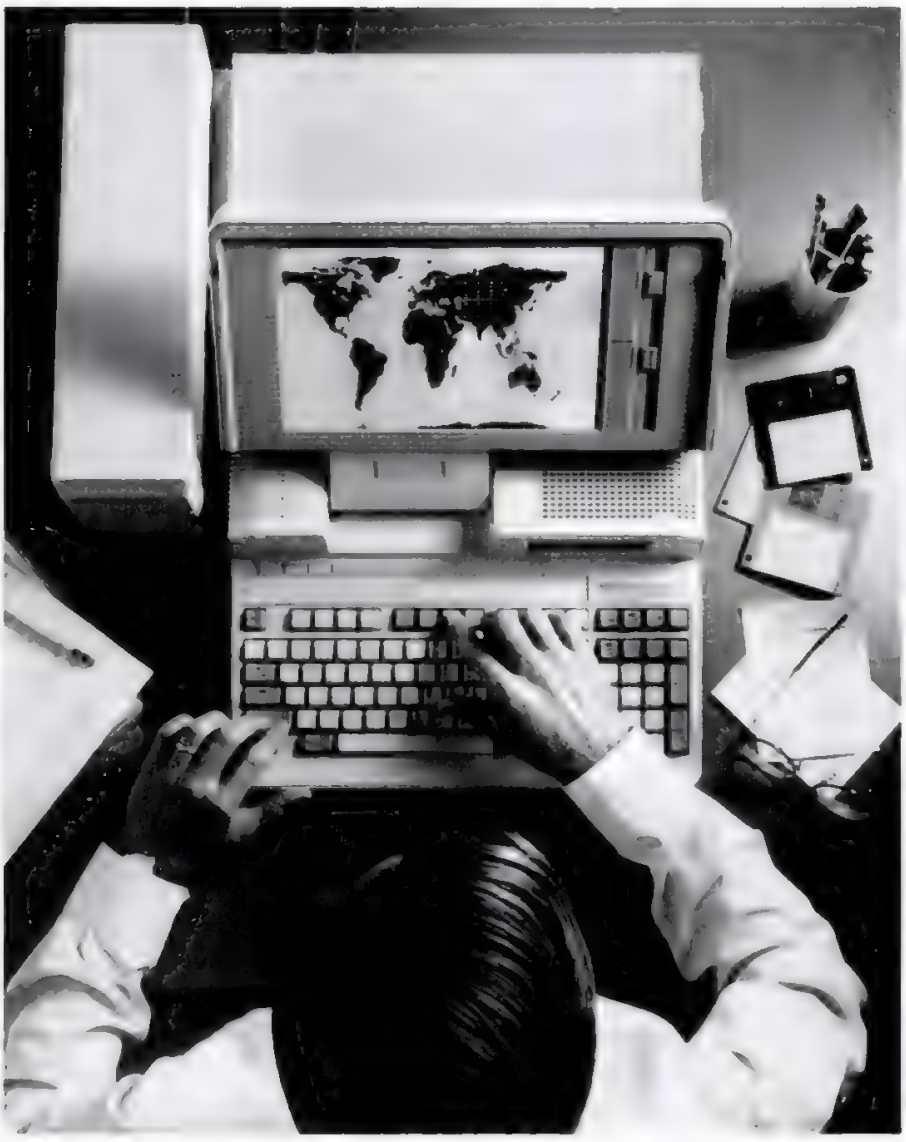

In the past, people who were serious about their computers have had a serious dilemma.

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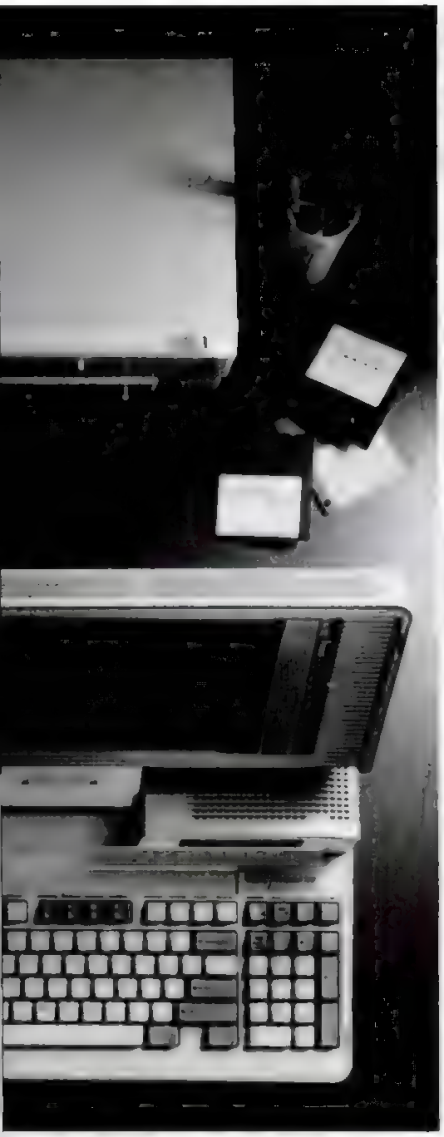
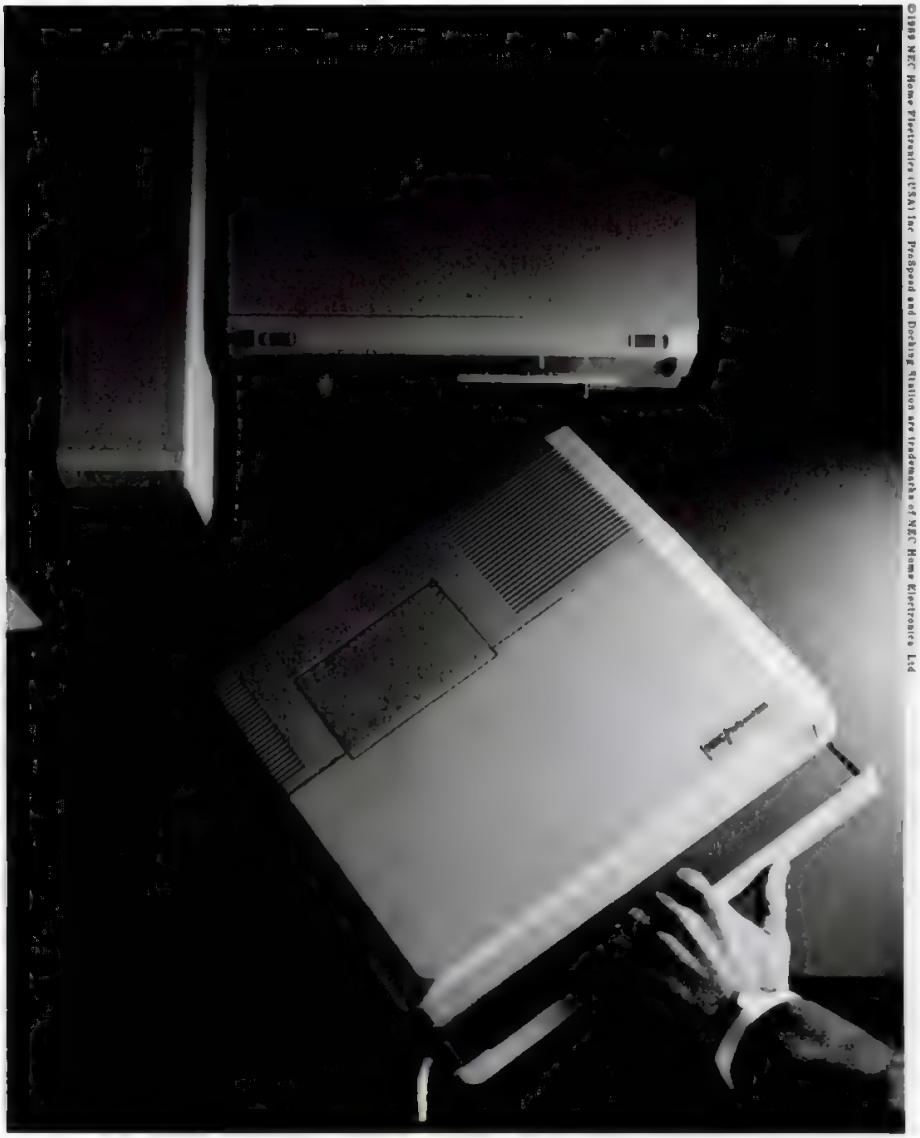
C&C Computers and Communications

you have to take it apart.





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$399 Atari Portfolio Takes On Hand-held Poqet PC

HANDS ON
by Jonathan M. Erickson

Atari's hand-held computer, the Portfolio, is an entirely new kind of personal productivity tool. Far more powerful than mere organizers like the Sharp Wizard and the Casio BOSS, the Portfolio is a serious computer that fits in your pocket. But you won't have to remove all the cash from that pocket to make room for it.

Comparisons to The Poqet PC (see First Looks, *PC Magazine*, November 14, 1989, page 33) seem natural at first glance, since the Portfolio is almost identical in size (1 by 7.87 by 3.87 inches (HWD) with the screen folded down) and weight (1 pound) and offers some of the same design innovations and capabilities. But a closer look reveals differences as well as similarities.

Unlike the Poqet, the Portfolio isn't fully DOS-compatible, and at $399, it costs a small fraction of the Poqet's hefty $1,995 price. But Atari's designers have torn a few pages from Poqet's book. The Portfolio runs on ordinary AA batteries, like the Poqet, and uses static RAM for its 128K standard memory, just as the Poqet uses SRAMs for its 512K complement. Both machines keep memory live when they are powered down, so you can pick up where you left off in an application with the touch of a key.

If it senses no activity for a few minutes, the Portfolio powers down into standby mode. The screen goes blank, but the contents of memory remain intact. The screen flickers to life every 2 minutes, when the Portfolio checks to see if it needs to sound any of the user-configurable alarms associated with the built-in appointment diary. This active approach to power management mirrors techniques used by the designers of The Poqet PC.

Both machines can execute software in ROM, which stretches their relatively small memories. Battery-backed SRAM card drives take the place of floppy disk drives; the Poqet comes with two such drives, while the Atari sports only one, located on the left side of its case.

For its surprisingly low price ($399), the Atari Portfolio offers considerable computing power. The Portfolio's built-in applications are file-compatible with many DOS programs.

A peripheral connector on the right side of the 8088-based Portfolio's case accepts a parallel ($49.95) or serial ($79.95) port module. Both of these options will be required equipment for PC users—the parallel port is necessary for use of the Portfolio's ROM-based file-transfer software, and the serial port is a prerequisite for use of a modem.

Unlike the Poqet's 80-by-25 display, the Portfolio's LCD screen supports 40 columns by 8 lines. A setup option lets you run some standard 80-by-25 software by windowing the Portfolio's smaller screen around the full-sized display.

Unfortunately, the Portfolio's display doesn't support any of the usual PC graphics standards. It also lacks support for the flashing, underline, and high-intensity character attributes of the IBM MDA standard. The Poqet's CGA support, by contrast, gives it access to a wide variety of DOS software. The Portfolio does have a graphics controller, the Hitachi HD61830. Atari says it is working with several software vendors to develop card-based versions of popular PC applications that will run on the Portfolio.

In the meantime, you can transfer DOS applications to the Portfolio's memory cards and run them, subject to the system's limitations. Since the largest storage card so far available holds 128K ($199.95; 32K card, $79.95), most serious PC applications are disqualified. Only character-based applications will run, since the Portfolio doesn't support PC graphics. And to run successfully, applications must only make standard DOS and BIOS calls.

We did find some small DOS programs, including a text editor, that run on the Portfolio, but it really isn't intended as a DOS clone. The ROM-based DIP operating system is written to closely mimic DOS 2.11, so DOS users will be instantly familiar with the majority of the operating-system commands. You format disks, list directories, and copy files exactly as you would on a true-blue PC.

Even without the future software support that Atari promises, the Portfolio is immediately useful. The system's ROM-based standard applications—an editor, a spreadsheet, a calculator, an address book, and an appointment diary—provide considerable productivity right out of the box.

The editor reads and writes plain ASCII files, which makes it a convenient adjunct to a wide variety of desktop word processors. It lacks modern amenities like spell checking, but it does offer basics like word wrap and search-and-replace.

The 127-column-by-255-row spreadsheet reads and writes .WKS files, so you can cart around chunks of your favorite spreadsheet. As with the editor, features and functions are limited, but the basic components are there.

It's impossible to talk about the Portfolio's software without discussing the quality of the screen and keyboard; both are quite usable. The screen's size and its limited display width and depth are problematic, but those don't hurt the quality of the image. The high-contrast characters are bright and legible.

The Portfolio's keyboard is too small for most people to touch-type on, but the QWERTY layout and excellent feel make two-fingered typing quite viable. The keyboard should not prove a hindrance in most note-taking or data-entry situations, but volume typing would be no picnic.

The Atari Portfolio is the first serious palm-top computer that fits in a leather portfolio and doesn't require you to liquidate your stock portfolio in order to afford it. ■

FACT FILE

Atari Portfolio
Atari Computer, 1196 Borregas Ave., Sunnyvale, CA 94088; (800) 443-8020
List Price: Atari Portfolio, $399; optional serial port, $79.95; optional parallel port, $49.95.
In Short: Atari's 1-pound hand-held Portfolio offers some of the same design innovations and capabilities of the considerably more expensive Poqet PC, but it isn't fully DOS-compatible.

CIRCLE 436 ON READER SERVICE CARD

PHOTOGRAPH: THOM O'CONNOR

Adobe Streamline Converts Scanned Bitmaps to Editable Vector Images

HANDS ON
by Edward Mendelson

Of all the raw materials of desktop publishing and presentation graphics, scanned images are the rawest. You can't change the scale or proportions of a scanned bitmap without sacrificing clarity and detail, and the scanning process itself invariably distorts and degrades the original image.

Adobe Streamline, from Adobe Systems, is the first program for the PC that automatically converts scanned bitmaps into vector images—patterns of lines and curves that can be scaled or modified without loss of quality. This $395 *Microsoft Windows* application takes in .PCX or TIFF files and sends them out again in any of three vector formats: Encapsulated PostScript, *Adobe Illustrator*'s .AI format (also usable with *Corel Draw!*), and *Micrografx Designer*'s .DRW format.

Using *Adobe Illustrator*, *Corel Draw!*, or *Micrografx Designer*, you can modify converted images so that, for example, an irregular ellipse on a scanned image becomes a perfect circle when you're ready to print. Using *Corel Draw!* or *Micrografx Designer*, you can also export *Streamline*-converted images in formats that can be printed by non-PostScript printers.

The task of converting scanned images could scarcely get more streamlined than it is in *Streamline*. Unlike the autotrace function in *Illustrator* and similar programs, which make you click on individual graphical elements to be traced one by one, *Streamline* traces and converts a whole image while you wait. You simply click on the name of the .PCX or TIFF file you want to convert and then walk away from your computer. After 1 to 10 minutes, depending on the complexity of the image and the speed of your machine, you can return to find the converted image displayed on your screen and the converted file stored on your disk. If you click on a group of filenames, *Streamline* will convert a whole directory's worth of images while you have a second cup of coffee.

That's all you need to do if your scanned images take the form of irregular filled outlines—the kind familiar from woodcuts or from drawings made with a broad brush or soft pencil. *Streamline* converts images like these with often stunning accuracy.

The results tend to be less stunning when you use images that consist of fine lines or a mixture of fine lines and filled outlines, and the job of conversion tends to be trickier. With such images, you have to tell the *Adobe Streamline* program which of its three built-in conversion methods to use, and you have to make fine adjustments to the way the program uses those methods. The result will often be an imperfect compromise between truth to the large form of an image and accuracy in its small details.

Streamline employs either an Outline method of conversion, a Centerline method, or a combination of the two. The Outline method, which you'll probably use most often, converts a bitmap by tracing a line around each of the black or white regions of the image and then filling in the outlines with black or white to match the original. You can adjust the "noise level" to ignore small imperfections in the scanned image, but this technique also sacrifices fine detail. With some recalcitrant images, no setting yields ideal results.

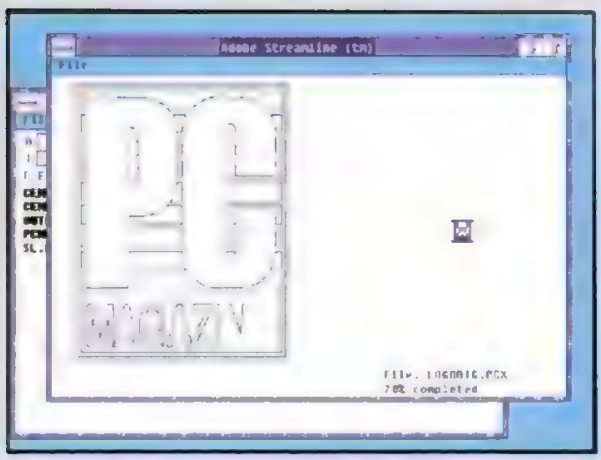
You use the Centerline method for scanned images of line drawings. This method works by tracing lines down the center of the lines in the bitmap instead of around shaded areas. An option menu lets you tell the program to smooth out small irregularities in the lines or to follow every twist and turn. If the program tries to follow the twists, the converted lines sometimes show extraneous "teeth" or similar artifacts that you'll have to eliminate with a drawing program.

With images that include both lines and filled areas, you choose the combination method. This can be problematic if any of the filled areas become narrow, because the program treats those narrow regions as lines. The resulting image will have some abrupt shifts from outline to line that can require tedious editing.

You can't solve these problems by converting different areas of a single image with different methods or settings. However, you can select a rectangular area from a larger image and convert it separately. With time and patience, you could convert parts of an image into separate files and then recombine them using a drawing program.

Streamline gets confused when tackling regions bounded by closely adjacent parallel lines, which it converts as nonparallel. When converting a bitmap of the *PC Magazine* logo that had been created in a paintbrush program, *Adobe Streamline* tapered the vertical lines on the M and N. Adobe's technical support staff, which hadn't encountered this problem before, suggested option settings that reduced the effect but didn't eliminate it.

Adobe Streamline sometimes seems to get things backwards: Ctrl-O brings up the Convert menu, while Ctrl-C brings up the Options menu. But when you *want* to get things backwards, by inverting a black on white image to white on black, *Streamline* is clever enough to oblige. ■



As it converts a bit-mapped image into vector format, *Streamline* displays the percentage completed.

FACT FILE

Adobe Streamline
Adobe Systems Inc., 1585 Charleston Rd., P.O. Box 7900, Mountain View, CA 94039-7900; (800) 344-8335.
List Price: $395.
Requires: 640K (expanded memory required for images larger than 20 square inches), hard disk, *Microsoft Windows* 2.03 or later, DOS 3.1 or later.
In Short: The PC's only automatic program for converting bitmaps to vector images. Highly effective, but many converted images will need editing in a drawing program.

CIRCLE 447 ON READER SERVICE CARD

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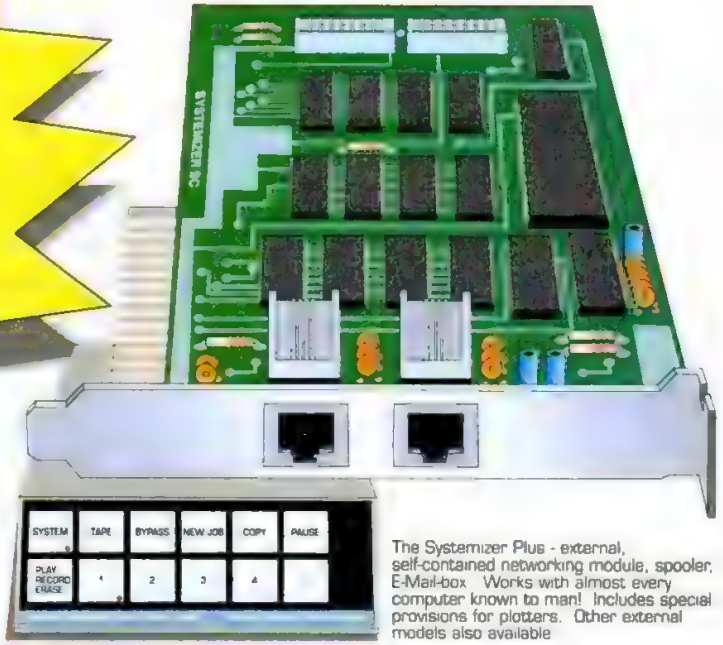

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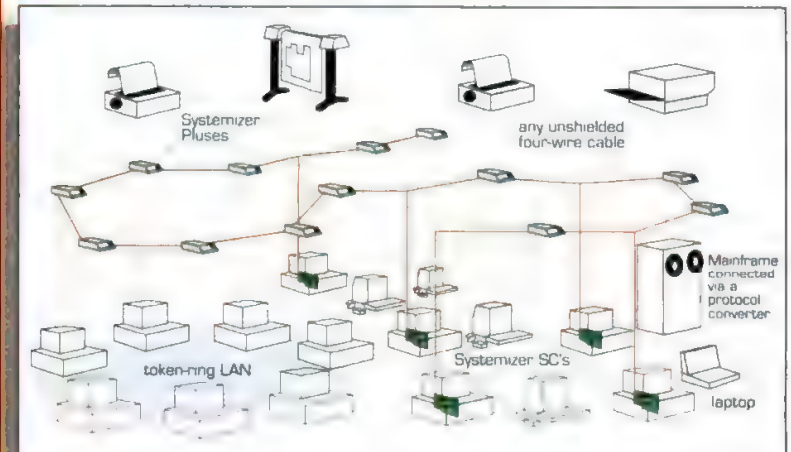

Example: 17 micros, of various brands, *plus* a mainframe, all sharing printers, data and E-Mail via Systemizing. Note how some PC's on a token-ring LAN are also part of the Systemizer LAN

Systemizing has become the connectivity standard at many of the world's largest corporations and throughout the federal government. Ten's of thousands are already in use. The new Systemizer SC is the latest model in Applied Creative Technology's line of Systemizing products, and it delivers what 95% of corporate computer users want from a Local Area Network— at far less cost and complexity, and yet with much more versatility.

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CIRCLE 477 ON READER SERVICE CARD

Norton Builds Alternative to Lotus Express, File Transfer Into Commander 3.0

HANDS ON
by Lori Grunin

Rather than merely tweaking *The Norton Commander*'s DOS shell, Peter Norton Computing has added major new enhancements to this handy program that even the most jaded user will appreciate.

Version 3.0 ($149) offers a spruced-up main shell that incorporates additional file viewers and integrates them into a Quick View that lets you see the contents of files in one panel as you scroll through the list in the other panel. You can zoom in on files and search for text strings within them.

Another new addition, Commander Link, lets you perform serial file transfers between two machines. Although it's not as full-featured as dedicated file-transfer packages, it's perfectly serviceable—as well as one less package to learn and install on your laptop.

The last new feature, Commander Mail, offers *Lotus Express* sufferers an alternative for handling their MCI Mail communications—it can handle binary file transfers over MCI, one of the few advantages that *Express* has over generic communications packages.

Unlike *Express*, Commander Mail lets you attach groups of files to messages without having to type and retype long pathnames. You merely select the files and choose Send Files from the menu.

The driver that controls background polling uses less than 95K, almost half the minimum RAM required by the combination of *Lotus Express* and *Lotus Metro*. Messages can be fetched and sent at scheduled times or on demand.

Lamentably, Commander Mail has several major flaws: if it receives an error report from MCI while sending a message, it downloads the error message and aborts the operation without sending or receiving the rest of your mail. Also, when sending groups of files, a bug truncates any list of more than approximately 70 characters.

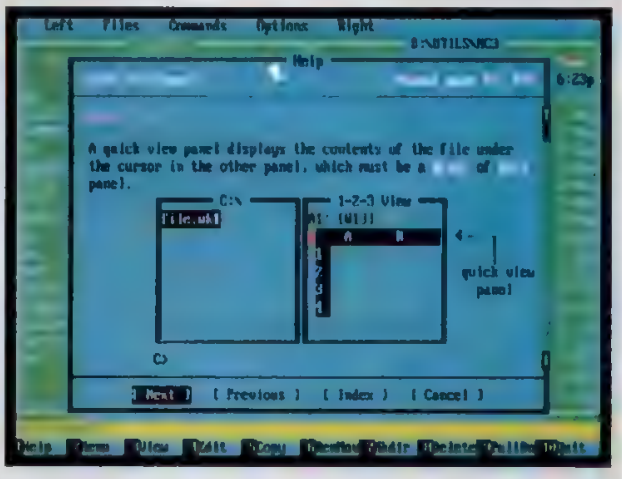
Nor can it handle frequently used distribution lists—you *always* have to select addressees from one long, unsorted address book.

Although Commander Mail has an In Box for downloaded messages, it doesn't have the equivalent of Drafts, Sent, or Outgoing folders. This is a nuisance, but since messages are organized into corresponding subdirectories and saved in files named for the sender or recipient, they can be easily viewed and edited using the shell.

The Norton Commander is a good, very flexible DOS shell that gets better all the time. Adding Commander Mail was an ambitious task. Once its programmers smooth out the wrinkles, *Commander* will graduate to the "software I can't live without" category. ■

List Price: *The Norton Commander*, Version 3.0, $149.
Requires: 178K RAM (to load; 13K when resident). Peter Norton Computing Inc., 100 Wilshire Blvd., Santa Monica, CA 90401; (213) 319-2010.

CIRCLE 446 ON READER SERVICE CARD



The Norton Commander now has real on-line help, complete with diagrams and manual references.

Switch-It Exchanges Applications, Alleviates RAM-Cram

HANDS ON
by Rock Miller

If you don't need the fancier capabilities or the configuration headaches of a full multitasking environment, take a good look at *Switch-It*. Using only 26K of RAM, this program lets you switch between running applications and helps alleviate RAM-cram by letting you put pop-up notepads, calendars, and other TSRs in their own workspaces. The package, which includes a cut-and-paste utility and a DOS command-line editor, costs $79.95.

Simplicity is the operative word here, starting with the installation program, which scans your hard disk for the programs it recognizes. There aren't many, but installing a program that isn't on the list is almost as easy. Using a separate configuration program, you simply specify the program, the amount of RAM it uses, the initial directory, the hotkeys, and whether to swap it to expanded memory or disk.

Switch-It is just as easy to operate. You can switch to an application either by pressing its hotkey or by hotkeying to the *Switch-It* menu and selecting the application from there. If the application isn't running when you select it, *Switch-It* will start it up for you.

Switch-It offers little in the way of options to enhance performance. You can choose to swap any task to expanded memory, but only if there's enough room for the entire workspace—otherwise, the program swaps to disk. This is naturally much slower, so you need to conserve expanded memory for your most important applications. But if you trim the size of your workspaces as much as possible and swap infrequently used applications directly to disk, you'll find this design adequate.

Switch-It proved remarkably free of glitches. You may need to learn a few tricks with batch files, and you should be careful to load network shells and background communications programs before *Switch-It*; otherwise you may swap them out and leave your session hanging. But with conventional applications and TSRs, we found no significant problems.

Switch-It doesn't run multiple tasks simultaneously like *DESQview*, and it can't swap in background processes like *Headroom*. But by sticking to the basics, *Switch-It* turns out to be both easier to set up and more reliable to use than these more sophisticated alternatives. You may find it a more practical choice. ■

List Price: *Switch-It*, $79.95
Requires: 256K RAM, DOS 2.1 or later; hard disk and/or expanded memory recommended. Better Software Technology Inc., 55 New York Ave., Framingham, MA 01701; (508) 879-0744.

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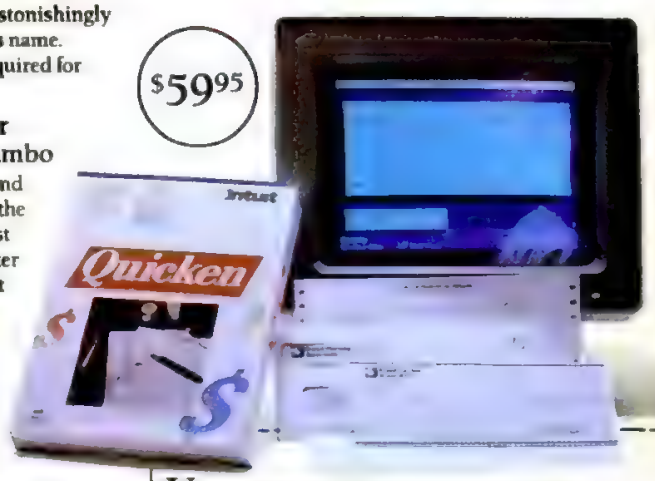

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Deluxe Paint II Enhanced Gains Better Presentation And Export Capabilities

by Luisa Simone

If you want to create elegant paintings, you'll need sophisticated tools. *Deluxe Paint II Enhanced*, the newest version of Electronic Arts' powerful paint program, *Deluxe Paint II*, gives you plenty of these. In addition, the $129.95 package offers somewhat-improved presentation and file-export capabilities, addressing—but not eradicating—some of its predecessor's weaknesses.

A utility new to *Deluxe Paint*, Gallery, lets you present your paintings in a runtime screen-show format. You can shuffle handy thumbnail sketches of your graphics on-screen to fine-tune the sequence of the show. Unfortunately, limited scripting capabilities restrict your use of the seven special-effect transitions the program provides. You must either choose one effect for the entire show or allow the program to select randomly from the various fades, zooms, and vertical blinds as it automatically segues from one image to the next.

Desktop publishers will applaud *Deluxe Paint*'s newfound ability to read and write .PCX files. However, the ancillary conversion program produced erratic results when we translated images to and from TIFF format. Exported images worked flawlessly with *PageMaker* as long as we converted colors to black and white. When we attempted to retain colors or shades of gray, we received an "Invalid file format" error message.

If you've used *Deluxe Paint II*'s impressive toolset, you might not think Electronic Arts' designers could improve it. They have. Left-drag on most items in the toolbox, and secondary-level icons pop up, giving you access to such features as rotatable ellipses, variable brush tips, dithered colors, and 16 customized gradient fills.

***Deluxe Paint II Enhanced*'s sophisticated gradient-fill options let you create more-realistic images.**

PHOTOGRAPH: THOM O'CONNOR

Deluxe Paint II Enhanced makes spectacular use of those gradient fills. You can control the amount of dithering, the direction of the color flow, the starting point, and whether or not the fill will follow the contours of a shape. I especially liked the brush-wrap feature, which distorts a multicolor custom brush so that it follows the outline of irregularly shaped objects, thus creating startling 3-D illusions.

Although the wisely reorganized menu makes it easier to find standard painting features, the newest effects—contrast, translucence, and anti-aliasing—are in the Miscellaneous menu, an illogical location. These effects really shine only when you have access to 256 simultaneous on-screen colors.

To tap all this power, you'll need every ounce of extended or expanded memory your system can muster. Without extra RAM, functions like stencils and brush transformations generate more memory error messages than they do paintings.

Deluxe Paint II Enhanced is not a program to buy for its ease of use. With more features than its closest competitor, *PC Paintbrush IV*, the program takes real effort to learn. But the results it lets you achieve are well worth the trouble. ■

List Price: *Deluxe Paint II Enhanced*, $129.95. **Requires:** 640K RAM, graphics adapter, mouse, DOS 2.11 or later. Electronic Arts, 1820 Gateway Dr., San Mateo, CA 94404; (415) 571-7171.

CIRCLE 436 ON READER SERVICE CARD

TreeSaver Reduces Paper Consumption, Print Time

by Michael Holmes and Bob Flanders

Discoversoft's *TreeSaver* invades territory previously occupied by photocopiers. The $89.95 program reduces the size of print and graphics, allowing you to squeeze more information onto a single page.

TreeSaver compresses graphics up to 75 percent by intercepting data sent to the printer and translating it into PCL appropriate for the job. For printing character-based data, it uses its own tiny fonts.

The program works with HP LaserJet Plus, 500 Plus, Series II, Series IID, or compatible printers and needs a minimum of 18K of RAM. If you have EMS memory, *TreeSaver* only uses about 900 bytes of DOS memory and anywhere from 32K to 64K of EMS memory.

TreeSaver offers four modes of operation. In Single mode, *TreeSaver* is transparent to the application, sending print codes through without translation. In Two-Up and Four-Up modes, the program prints either two or four "pages" per sheet of paper. In Scaled mode, *TreeSaver* reduces the image by a factor specified at setup.

Each scaled page is printed on a single sheet of paper. All modes can be selected easily with programmable hotkey combinations. In addition, *TreeSaver* can print up to 218 characters per line by 127 lines in portrait mode, or 289 characters per line by 96 lines in landscape mode.

TreeSaver saves print time as well as paper. In one of our informal tests, a 12-page print job sent with the DOS COPY command took 1 minute, 44 seconds in Single mode and just 64 seconds in Four-Up mode.

TreeSaver isn't without shortcomings. In some network environments, the program isn't invoked when printing to a network printer; it loads as usual but does not translate data sent to the printer. Also, *TreeSaver* doesn't let you change startup parameters (such as the reduction factors for Scaled mode) without unloading and reloading the program.

Nevertheless, the savings in paper consumption and print time that *TreeSaver* affords far outweigh its minor problems. ■

List Price: *TreeSaver*, Version 1.01, $89.95. **Requires:** 18K RAM or 32K EMS; HP LaserJet Plus, 500 Plus, II, IID, or compatible. Discoversoft Inc., 1516 Oak St., #307, Alameda, CA 94501-2958; (415) 769-2902.

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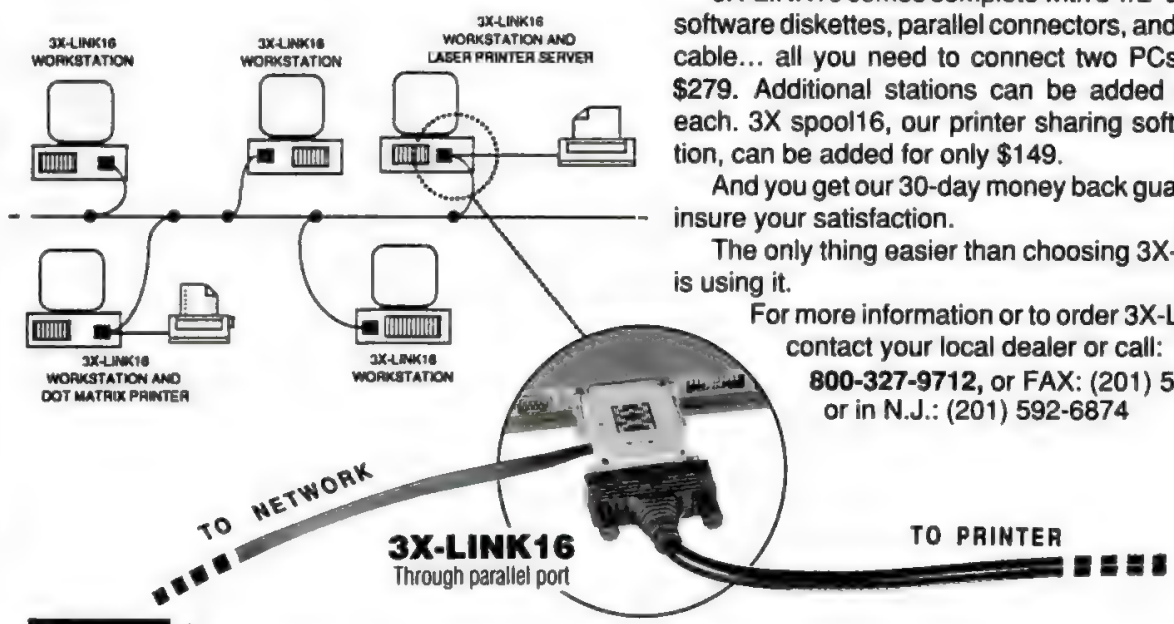

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71MB/25MS MFM	$ 810	$ 990	$1,250	$1,425
105MB/25MS RLL	$ 860	$1,040	$1,300	$1,475
150MB/23MS ESDI	$1,280	$1,460	$1,720	$1,865
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CIRCLE 163 ON READER SERVICE CARD

PrintVision Adds Page Preview to Existing Applications

HANDS ON
by Mark Minasi

If your favorite software doesn't come with graphical page preview, you needn't resign yourself to printing endless drafts. Bloc Publishing Corp.'s *PrintVision* can add this feature to any application for $69.95, provided you have a Hewlett-Packard LaserJet, DeskJet, or compatible printer.

PrintVision is a memory-resident program that intercepts and interprets the printer codes sent by your application. Once it's loaded, *PrintVision* waits for its moment on stage, then pops up a graphical representation of the page.

You can zoom in on a section of the page using a fixed box that you move around with the arrow keys. You can print the page if you're satisfied with it, or you can proceed to the next page without printing. A pop-up menu lets you disable, reset, or uninstall the program.

PrintVision's main drawback is that it can preview only one page at a time. This means you can't scroll from page to page before printing, and because the program doesn't spool your print jobs, you have to wait for each page to finish before proceeding to the next. You also can't print from the zoomed display, and waiting for the unzoomed one to redraw before printing is time-consuming.

PrintVision handles fixed-pitch internal fonts and PCL graphics quite well, in spite of the relatively low resolution of the PC screen. Alas, the program is less adept with proportional fonts. The width tables supplied with the program support only a selection of LaserJet font cartridges. And the program has only a limited range of screen fonts, so the text you see often doesn't look much like what you'll get. But it is good enough for preview purposes.

Consider these other caveats. Since *PrintVision* monitors only parallel printer devices, if you have a serial printer, you'll need either to redirect the program's output with the DOS MODE command or use *PrintVision* only for on-screen preview. And since it can only duplicate what's sent in the print stream, downloaded macros and front-panel settings aren't recognized; you can, however, adjust the setup program for some printer defaults, as well as the symbol set and font cartridge.

Though it can't be as thorough as a print preview module built into an application, *PrintVision* works well on bread-and-butter jobs. Bloc Publishing is working on an updated version that supports Epson's 9- and 24-pin printers, IBM Proprinters, and LaserJet soft fonts. In the meantime, *PrintVision* is a handy tool for the LaserJet user. ■

PrintVision interprets the printer codes sent by your application, then pops up a graphical depiction of the page.

List Price: *PrintVision*, $69.95. **Requires:** 64K RAM; Hercules, CGA, EGA, or VGA graphics adapter; Hewlett-Packard LaserJet, DeskJet, or compatible; DOS 2.0 or later. Bloc Publishing Corp., 800 SW 37th Ave., #765, Miami, FL 33134; (305) 445-0903.

CIRCLE 431 ON READER SERVICE CARD

CLINES/CTREE Reformats, Maintains C Source Code

HANDS ON
by Salvatore P. Ricciardi

If you're looking for a way to keep your C source code neat and clean, Gimpel Software's *CLINES/CTREE* may just do the trick. This $79.95 suite of development and maintenance tools specializes in the reformatting and printing of C programs and provides a number of methods for analyzing code.

CLINES/CTREE consists of three highly configurable programs. CFORMAT will reformat your C program using any of several different coding styles. For example, you can specify that left and right braces should occupy a line by themselves and be vertically aligned.

CFORMAT will break lines where necessary. For instance, it can take a series of C statements that are combined on one line and split them into as many lines as are required while maintaining the correct indentation. This feature makes the program especially valuable for converting other people's source code to the style that you prefer.

A second included program, CLINES, prints formatted listings of C source code, using indenting and outlining to indicate program constructs. Vertical lines are drawn to the left of the code to outline the beginning and end of a block, and exit points are marked, as well. This technique helps to bring out the structure of a program and is useful for spotting errors.

CLINES supports the IBM block characters for vertical lines, or you can use ASCII characters if your printer doesn't support the full IBM character set.

CLINES can print detailed cross-references, including a multifile cross-reference. Each symbol is listed, along with the filenames and line numbers in which it is referenced. Variable and procedure declarations and macro invocations are specially marked. You can embed titles and subtitles in comments within your code and have CLINES use them on page headings and in a listing index.

CLINES can take its list of files to be printed from the command line or from a file-list file. The program fully supports wildcards and handles several useful extensions. You can list filenames to be read but not printed or to be excluded. You can also select ranges within a file for processing.

The third piece of the package, CTREE, lets you create a number of useful reports based on the data created by CLINES. For example, CTREE can produce a hierarchy tree report showing function calls and global variable usage. You can also request a report listing all functions that access a specified variable.

A must for C programmers, *CLINES/CTREE* will pay for itself as soon as you use it to convert someone else's code to your own style. ■

List Price: *CLINES/CTREE*, $79.95. **Requires:** 384K RAM, DOS 2.1 or later. Gimpel Software, 3207 Hogarth Ln., Collegeville, PA 19426; (215) 584-4261.

CIRCLE 432 ON READER SERVICE CARD

Here's what PC Magazine says about Micro 1 Power 386 Computers:

May 30, 1989

"When it comes to computers, you have to choose between price and performance, right? Meet the Micro 1 Power 386-16 and Micro 1 Power 386-20, the two computers that are fast turning this belief into a misconception.

Despite their low prices, the Micro 1 machines don't give up any points in the performance arena...both models come complete with hardware memory cache. This no doubt helped the systems turn in impressive results on the memory bench-mark tests, each machine logged in times that often placed it near the top of its class.

...the low prices and superior performance of the Micro 1 machines makes them a bargain you have to consider.

In short: The Micro 1 Power 386 computers are big on performance and low on price...these models may well represent some of the best values in their class."

Feb. 28, 1989

"I don't know how it's doing it, or why, but Micro 1 is bursting the biggest barrier to buying an 80386-based computer: price. A mere $1995 buys you the Micro 1 Power 386-20--not just a system board in a case, but an entire computer system complete with hard disk and display.

It's not just cheaper than any other 386 on the market, it's cheaper than any 386SX, the IBM PS/2 Model 30 286 or even an equivalent scratch-built computer...the Micro 1 Power 386-20 stands up admirably against the three times more expensive Compaq Deskpro 386/20...all the components that make up the Power 386-20 rank as first rate...the Micro 1 Power 386-20 rates as the best buy around."

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- 101 Keytronics keyboard

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Alan Cohen

New&Improved

News of Announced Products and Upgrades

Vi-Spy Scans Disks For Aberrant Code, Detects 22 Viruses

NEW

With computer viruses and the threat they pose to PCs becoming big news—and a big worry—there's been an avalanche of "virus sniffers" hitting the market. The vast majority of these virus-detection packages run as TSRs and sound alarms whenever anything strange happens to one of your executable files. *Vi-Spy*, a $250 virus-detection program from **RG Software Systems,** works differently. A scanning tool that surveys your disks, *Vi-Spy* looks for programming that matches the code of any of 22 currently known viruses.

Vi-Spy can scan network servers, hard disks, and diskettes at a speed of up to 150 files per minute, according to the company. If virus code is found, the program identifies both the infected file and the virus by name. You then have the option to erase the file—and thereby the virus—from your system. *Vi-Spy* purges files by writing zeros over data before erasing it, thus insuring that an undelete command will not bring back a very unwanted infection.

List Price: *Vi-Spy*, $250 (one-year subscription update service and troubleshooting support available for $150). **Requires:** 128K RAM, DOS 2.0 or later. RG Software Systems Inc., 2300 Computer Ave., Suite E-28, Willow Grove, PA 19090; (215) 659-5300.

CIRCLE 438 ON READER SERVICE CARD

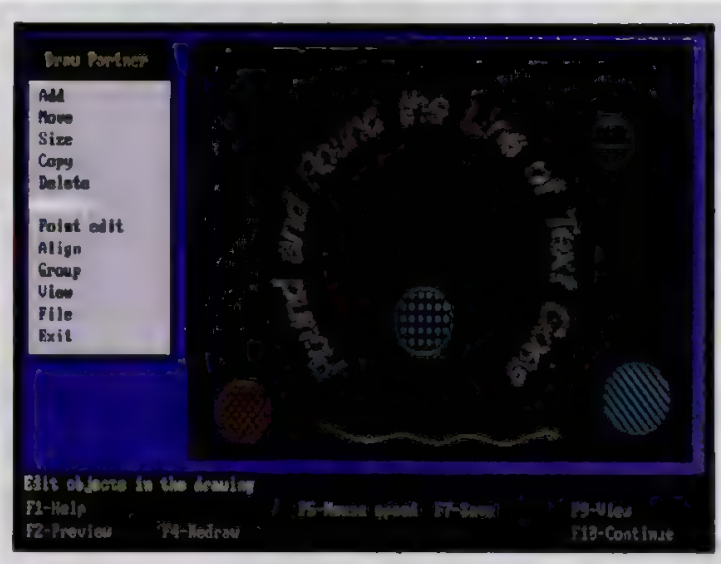
SPC Offers Drawing Package for Harvard Graphics

NEW

Draw Partner, an advanced drawing package for creating desktop presentations, joins **Software Publishing Corp.**'s growing line of accessories for *Harvard Graphics*.

The $149 package lets *Harvard Graphics* users rotate text, flip objects, create mirror images, and zoom in on and pan images. Furthermore, the package can import .CGM and Lotus .PIC files. A circular-text feature is provided, as well as the ability to show an object metamorphosing into another object and the ability to cut holes in overlapped objects. **List Price:** *Draw Partner*, $149. **Requires:** 512K RAM, *Harvard Graphics* Version 2.0 or 2.1, DOS 2.0 or later. Microsoft-compatible mouse or Summagraphics-compatible drawing tablet recommended. Software Publishing Corp., 1901 Landings Dr., P.O. Box 7210, Mountain View, CA 94039; (415) 962-8910.

CIRCLE 442 ON READER SERVICE CARD



Draw Partner gives *Harvard Graphics* users advanced drawing techniques, such as circular text and drop shadows.

HOT PROSPECT

VIDEOWINDOWS DISPLAYS REAL-TIME VIDEO ON VGA MONITORS

VideoWindows, from **New Media Graphics,** is an 80188-based video processor board that enables *Microsoft Windows* and *HP NewWave* users to display full-color, full-motion television images in scalable windows on-screen. Video can be mixed with computer graphics or frozen and stored on a hard disk in a VideoWindows, .PCX, or Targa file.

The $1,795 board digitizes an NTSC or PAL video signal and stores it in an on-board frame buffer. The image can then be manipulated and placed anywhere on the screen in real time. Once this is accomplished, the signal is converted back to analog, decoded in RGB, combined with VGA or EGA graphics, and displayed on a 60-Hz monitor such as the NEC MultiSync.

VideoWindows fits in a single full-size slot and, according to the company, operates transparently to the PC's graphics adapter. Other features include zooming and panning capabilities, fades, image compression to 1/4 and 1/16 screen sizes, cut-and-paste options, and support for up to 256 on-screen colors.

List Price: VideoWindows, $1,795 (including functions library for use with any Microsoft-compatible C language). New Media Graphics Corp., 780 Boston Rd., Billerica, MA 01821; (508) 663-0666.

CIRCLE 437 ON READER SERVICE CARD

New & Improved

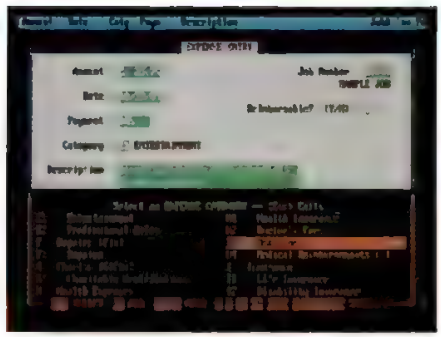
Spinnaker Software Helps Manage Your Home Office

NEW

Spinnaker Software's *BetterWorking One-Person Office* business management package targets not the corporate user, but the freelance or home-based professional who wants a one-stop solution for organizing a business.

The $69.95 program has three primary functions: tracking and categorizing expenses, invoicing clients, and managing a database of contacts.

Expenses can be organized by category, date, or project, and invoices automatically include and calculate particular expenses incurred for a job. Mailing labels can be generated through the contact database, and a reporting option—to print out such information as outstanding client balances and payments received—is also included.



BetterWorking One-Person Office categorizes and keeps track of your expenses.

List Price: *BetterWorking One-Person Office*, $69.95. **Requires:** 512K RAM, DOS 2.1 or later. Spinnaker Software, One Kendall Square, Cambridge, MA 02139; (617) 494-1200.

CIRCLE 441 ON READER SERVICE CARD

MicroSpeed Utilities Teaches an Old Mouse New Tricks

NEW

MicroSpeed Mouse Utilities is a $39.95 collection of enhanced mouse drivers and utilities designed to breathe new life into your aging 200-dot-per-inch pointing device and bring it into the 1990s.

The key element of *MicroSpeed*'s package is the MicroSpeed Automatic Precision (MAP) device driver. The MAP driver features an automatic ballistic gain controller, which makes a low-resolution mouse operate as if it were of a higher resolution. When you move the mouse slowly, the on-screen cursor moves pixel by pixel; as the rate of the mouse's motion increases, the cursor motion increases proportionally; this is what *ballistic gain* refers to.

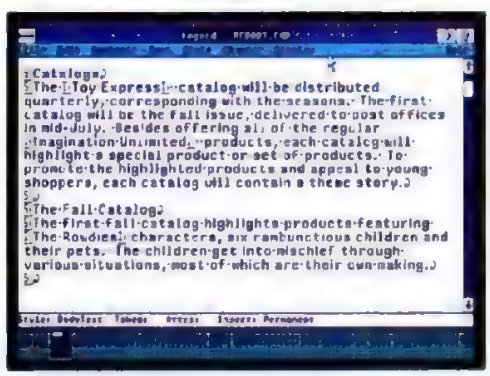
The utilities support all popular mice, in-

CONTINUES ON PAGE 59

IMPROVED

***DataEase*, Version 4.2**—DataEase International has incorporated a DOS extender into *DataEase*, Version 4.2, the latest upgrade of the company's relational database management system. Using Rational Systems' DOS/16M extender, the new release can address up to 16MB of RAM on 80286- and 80386-based PCs, allowing for the creation of larger *DataEase* applications. The package also runs in 640K on these machines, as well as on 808*x*-based systems. In addition, the new release boasts MultiForm referential integrity, which gives developers greater flexibility and control in maintaining links between records in different files, according to the company. Version 4.2 of *DataEase* retails for $750. Registered owners of Versions 4.0 and 4.01 who purchased the package after September 15, 1989, can receive the upgrade free of charge. Registered users of Versions 4.0 and 4.01 who purchased the program prior to that date can receive the upgrade for $50. The upgrade price for users of Version 2.12 is $200. DataEase International, Trumbull, Conn.; (203) 374-8000.

PC-Write Lite—A scaled-down version of Quicksoft's *PC-Write* shareware word processor, *PC-Write Lite* is intended for writers, students, journalists, and laptop users who do not need all the bells and whistles of a full-scale, RAM-hungry word processing package. While advanced formatting features have been removed from the new package, a word-count capability has been added, as has a page-preview feature. Document files and most commands are the same in the two versions, and the simplified program actually runs faster than its more powerful sibling, according to Quicksoft. *PC-Write Lite* requires 384K of RAM (256K if the spelling checker is not loaded). Full registration for the package (which includes the software, the manual, and one year of technical support) costs $49. For $29, you can receive just the disks and the manual, and for $12, the disks alone. Quicksoft Inc., Seattle, Wash.; (800) 888-8088; (206) 282-0452.



The upgraded version of *Legend*, for *Microsoft Windows*, features a non-WYSIWYG draft mode for easier editing.

***Legend*, Version 2.0**—The upgraded release of *Legend*, NBI's *Microsoft Windows*–based word processor and page-layout package, sports a draft mode that gives users of the WYSIWYG program a non-WYSIWYG environment for faster text entry and editing. The package, which is intended for 80286- and 80386-based PCs, has also been enhanced with page rulers and column guides, and it can now import .PCX and TIFF files. Furthermore, the new version lets you rotate images and adjust word and letter spacing. According to NBI, the new release is quicker than its predecessor, with certain text operations running up to 200 percent faster. *Legend*, Version 2.0, is available for $495. Registered owners of Version 1.1 are eligible to receive the upgrade to the new release free of charge. NBI Inc., Boulder, Colo.; (800) NBI-1111.

Disk Technician Advanced* and *Disk Technician Pro—Both an enhanced and a new version of *Disk Technician*, the hard disk utility package, are now available from Prime Solutions. *Disk Technician Advanced*, Version 6, the upgraded program, includes several added features, including a set of refined testing algorithms (using the new release, you can test your hard disk once a week instead of every day) and a pretest screen that explains and lists all test parameters (including the estimated testing time) before any procedure is actually initiated. This gives users an "escape hatch" should a particular test be deemed too time consuming. While *Disk Technician Advanced* can fully test and repair two hard drives automatically, the new product, *Disk Technician Pro*, which retails for $59.95, offers fully manual operation. *Disk Technician Advanced*,

CONTINUES ON PAGE 56

BORLAND'S NEW SPREADSHEET

THE BALANCE OF POWER: QUATTRO® PRO

	QUATTRO PRO*	Lotus 1-2-3* v 2.2	Lotus 1-2-3* v 3.0
PUBLISHING			
3-D Graphs	✓		
Built-in draw package	✓		
Individual cell font control	✓	✓	
Shading and borders	✓	✓	
Print graphs & spreadsheets side-by-side	✓	✓	
CONSOLIDATION			
Multiple spreadsheet windows	✓		✓
Multipage consolidation	✓		✓
Keyboard and mouse support	✓		
Lotus 1-2-3 v 2.01 compatibility	✓	✓	✓
Spreadsheet Capacity (NSTL)** 640K RAM	11	8	NA
Spreadsheet Capacity (NSTL)** 1Mb RAM	18	12	5
Price***	$495	$495	$495

*Clip art from PicturePaks™ by Marketing Graphics Inc. (MGI) **NSTL (National Software Testing Labs) measured spreadsheet capacity by counting how many years of data could be added to a spreadsheet. Large numbers mean greater capacity. Performance for v 2.2 is with Allways attached. ***Based on suggested retail prices as of October, 1989.

"QUATTRO PRO seems to do the impossible: It maintains compatibility with 1-2-3; adds functionality that no version of 1-2-3 has and still runs large spreadsheets in 640K."

PC WEEK, *September 4, 1989*

"Borland squeezes such features as multipage consolidation, advanced linking, and live graphics into a package that runs on 512K systems with its Virtual Real-Time Object-Oriented Memory Manager (VROOMM™) technology."

InfoWorld, *September 4, 1989*

QUATTRO PRO, with a unique balance of power, does *both* advanced publishing *and* multipage consolidation.

Lotus 1-2-3's Release 2.2 cannot do both. Neither can their Release 3.0 (see comparison chart).

QUATTRO PRO is compatible with 1-2-3.* It comes with a built-in draw package, clip art library,* and Bitstream* typefaces for presentation-quality output.

QUATTRO PRO does it all today.
Publishing. Consolidating. Presenting.

Call **800-331-0877** for a FREE trial version, demo disk, or upgrade information.

BORLAND

CODE: MQ22

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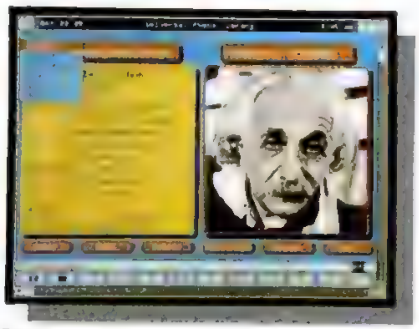
CIRCLE 377 ON READER SERVICE CARD

Pure GUInius



Design forms to integrate directly with the database. Build them into menu or push button driven solutions.

The benefits of graphical user interfaces (GUIs) are dramatic. Consistency. Ease of learning. Presentation quality output.

But to take advantage of them your application software has to be up to the task. That's where *Superbase 4 Windows* comes in. Conceived and designed as *the* GUI database system for the '90s, *Superbase® 4 Windows* sets new standards in ease of use and presentation quality, while its 4GL development tools are purpose built for GUI solutions.

Use the graphical form designer. Or the comprehensive Database Management Language. Manipulate forms from programs. Or call program commands from forms.

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Precision Software acknowledges all trademarks.

CIRCLE 136 ON READER SERVICE CARD

New & Improved

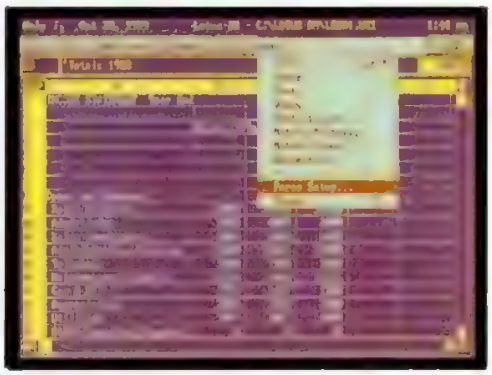
IMPROVED

CONTINUED FROM PAGE 54

Version 6, which includes SafePark, a background head-parking utility, is available for $149.95. Current owners of the package can obtain the upgrade for $25. Owners of Prime Solutions' earlier packages, *Disk Technician* and *Disk Technician Plus*, should contact the company for upgrade details. Prime Solutions Inc., San Diego, Calif.; (619) 274-5000.

SpinRite II—The new release of *SpinRite*, Gibson Research Corp.'s hard disk utility package, operates with DOS partitions of any size and is compatible with DOS 4.0. The upgraded version also builds a log of all findings and activities, creating a history of the hard disk's long-term operational status. According to the company, *SpinRite II* detects hard disk copy-protection schemes without disturbing them, and it can be used with high-performance hard disk controllers. The package retails for $89. Current users can obtain the upgrade for $25 by calling (714) 830-6200. Gibson Research Corp., Laguna Hills, Calif.; (714) 830-2200.

Lotus Spreadsheet for DeskMate—Lotus Development Corp. has coupled *Lotus 1-2-3* technology with Tandy's *DeskMate Graphical User Interface* to create *Lotus Spreadsheet for DeskMate*. The new release is an integrated software package featuring spreadsheet, database, and graphics capabilities. Under the *DeskMate* interface, the program incorporates pull-down menus and dialog boxes for ease of use. The spreadsheet does not, however, include several important features of *1-2-3*, such as macros, an add-in capability, and support for expanded memory. Nonetheless, the basic feature set is comparable to the full-blown version of *1-2-3*, and the package also includes a .WK1 file format that is fully compatible with Releases 2.0, 2.01, 2.2, and 3 and with *Symphony*. *Lotus Spreadsheet for DeskMate* also supports a mouse and works with all other *DeskMate* applications and accessories. The package, which includes a runtime version of the *DeskMate Graphical User Interface*, requires 512K RAM and is available through Tandy at any of the company's Radio Shack stores. *Lotus Spreadsheet for DeskMate* retails for $219.95. All product support and service will be provided by Lotus. Lotus Development Corp., Cambridge, Mass.; (617) 577-8500; Tandy Corp., Fort Worth, Tex.; (817) 390-3011.



***Lotus Spreadsheet for DeskMate* combines a scaled-down *Lotus 1-2-3* with Tandy's graphical interface.**

***Extend-a-Name Plus*, Version 3.02**—The latest version of World Software Corp.'s TSR file-managing utility supports a greater number of applications and includes several new features. Like its predecessors, Version 3.02 allows users to replace standard 8-character DOS filenames with 60-character strings, but the program now supports *Lotus 1-2-3*, Releases 2.2 and 3; *AutoCAD*, Version 10; *Paradox*, Version 3.0; *PlanPerfect*, Version 5.0; *Multimate Advantage II*; and *WordStar*, Version 4.0. Furthermore, the new release contains an attach feature that works with *Allways* files. Whenever a worksheet file is archived, copied, deleted, named, or renamed, *Extend-a-Name Plus* will automatically update the attached *Allways* file. Other new features of the program include a directory-tree window, a friendlier user interface, mouse support, point-and-shoot program selection, a 1,000-filename-per-subdirectory capacity, an archiving capability, extended triggers to access applications, and a view window. *Extend-a-Name Plus*, Version 3.02, retails for $89. Registered *Extend-a-Name Plus* users will receive the upgrade to the new release free of charge. Registered owners of the company's earlier release, *Extend-a-Name*, can obtain the upgrade for $30. World Software Corp., Ridgewood, N.J.; (800) 962-6360, (201) 444-3228.

BORLAND'S TURBO C PROFESSIONAL 2.0

CORPORATE TOP RATED PC WEEK 1989 SATISFACTION POLL

PC WEEK POLL: C COMPILERS

	Overall Weighted Score	Overall Reliability	Complete of Command Descript.	Overall Perform.	Complete & Organiz. Document.	Document Clarity	Compiling Process Efficiency	Product Support Quality	Value Relative To Cost	Product Support Access
Turbo C 2.0 (Borland International)	81	87	79	84	77	78	86	72	70	93
C Optimizing Compiler 5.1 (Microsoft Corp.)	76	83	80	81	78	74	76	68	67	70
C++ 1.07 (Zortech Inc.)	66	68	64	71	63	63	69	60	58	76

"Microsoft was No. 1, but they have been unseated by Borland." PC Week, *May 8, 1989*

PC WEEK POLL: SOFTWARE DEBUGGERS

	Overall Weighted Score	Overall Reliability	Effective Programmer Interface	Document. Clarity	Complete. Command Descript.	Complete. & Organiz. Document	Overall Perform.	Integration Within Programming Environment	C Compiler Compatibility	Product Support Quality	Product Support Access	Value Relative To Cost
Turbo Debugger 1.0 (Borland International)	84	89	90	81	81	81	89	88	81	73	72	93
Codeview 2.2 (Microsoft Corp.)	73	80	71	72	74	74	74	74	78	67	64	72

"Borland's Debugger outshines Microsoft's Codeview." PC Week, *May 15, 1989*

It's two winners in one.

Turbo C,* the core of Turbo C Professional, was the outright winner in *PC Week*'s Poll of Corporate Satisfaction on C compilers. Overall, Borland won with 81. Microsoft* placed second.

Turbo Debugger,* also included in Turbo C Professional, was the outright winner in EVERY category in *PC Week*'s Poll Of Corporate Satisfaction on Debuggers. And, once again, we topped the score with 84, overall. Microsoft came in second-best, 11 points behind.

Get Borland's Turbo C Professional and get the best of both worlds: our top-rated C compiler and our top-rated Debugger.

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Turbo C Professional includes both Turbo C 2.0 and Turbo Assembler® & Debugger.

BORLAND

Code: MC42

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CIRCLE 147 ON READER SERVICE CARD

PostScript Power For Your LaserJet. Only $195.

Without PostScript capabilities, the HP LaserJet™ is a magnificent, underutilized machine. In most offices it chugs. Now, in every office, it can fly.

With PreScript™, the exciting, new software package from POC, you can turn your LaserJet into a PostScript printer—without the high cost, the inconvenience, or the speed degradation of other upgrade solutions.

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Only PreScript gives you *online printing*, letting you print without exiting your application. Only PreScript gives you WYSIWYG *preview* capability, so you can see your document on the screen exactly as it will print. Only PreScript gives you full page graphics without a printer memory requirement.

And PreScript runs up to five times *faster* than other solutions, particularly for graphics intensive pages and pages that switch fonts frequently. For even faster printing, an optional PreScript interface card is available for use with the LaserJet Series II.

Plus, you get unlimited scalable, rotatable fonts along with all of the PostScript special effects, including support for powerful grey scale generation, character path, complex clipping, arbitrary image scaling and rotation, and curve drawing with flatness control.

PreScript requires no expensive printer controller. No extra printer memory. No external drivers. No soft fonts or font cartridges. No hidden costs.

So make your LaserJet take off for pennies. Power up with PreScript: 13 fonts ($195); 35 fonts ($395); optional interface card ($295).

System requirements: 286 or 386 PC with 2 MB of extended memory, DOS 3.1 or higher. PreScript also works with the HP DeskJet and other HP-PCL compatible printers.

CIRCLE 342 ON READER SERVICE CARD

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New & Improved

Mouse Utilities

CONTINUED FROM PAGE 54

cluding those from Microsoft, IBM, Logitech, and Mouse Systems. The MAP driver automatically adjusts to ten different ballistic gain settings, ranging from 50 to over 1,000 dots per inch.

MicroSpeed Mouse Utilities also includes a companion driver with automatic gain adjustment for use with *Microsoft Windows*, a keyboard emulator, and pop-up menus for *Lotus 1-2-3*, *WordPerfect*, and *dBASE III* and *dBASE IV*.

List Price: *MicroSpeed Mouse Utilities*, $39.95. **Requires:** 256K RAM, mouse, DOS 2.0 or later. MicroSpeed Inc., 44000 Old Warm Springs Blvd., Fremont, CA 94538; (800) 232-7888; (415) 490-1403.

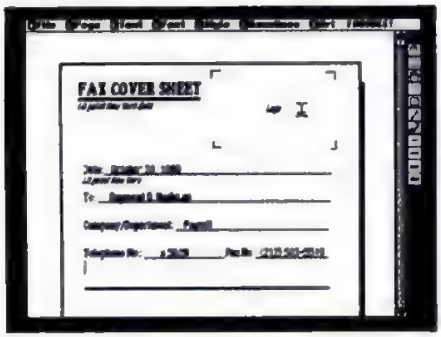
CIRCLE 439 ON READER SERVICE CARD

PFS:First Publisher Add-On Provides Ready-made Document

NEW

Users of *PFS:First Publisher* who need a few basic types of documents and need them quickly may find **Software Publishing Corp.**'s new *Business Template Kit* to be a handy time-saver.

A collection of 20 business templates, the package includes predefined page layouts for such documents as fax cover sheets, certifi-



The *Business Template Kit* gives *PFS:First Publisher* users a quick and easy way to create simple documents.

cates, announcements, newsletters, mailers, memos, menus, and resumes. Users need only pick the template and fill in the data. Seven new typefaces and over 100 clip-art images are also provided.

List Price: *Business Template Kit*, $89. **Requires:** *PFS:First Publisher*, Version 2.0 or later. Software Publishing Corp., 1901 Landings Dr., P.O. Box 7210, Mountain View, CA 94039; (415) 962-8910.

CIRCLE 440 ON READER SERVICE CARD

Convert Your /AT to a Fast 20MHz 386

with or without CACHE

In A Flash.

IF Your Technology is Behind The Time, And Higher Performance Is Needed, Get In Today's Cockpit With A DTI CAT-KIT And Convert Your /AT Or /XT To A True 386 Machine With 20MHz SUPERsonic Speed.

THIS IS NOT AN ACCELERATOR BOARD

After a simple installation of our 386 CAT-KIT you will have a new fast /AT 386 computer ready for years of service. The DTI 386 CAT-KIT removes the need for your old motherboard. Available in 16 and 20MHz versions. This kit allows you to utilize your existing Chassis, Power Supply, Add-On Cards, Drives, Monitors, Keyboards and Peripherals. Available with Cache.

With PRIDE

Made in the U.S.A.

Be All That You Can Be -Enlist now and fly a 386 machine today!

Diversified Technology
An ERGON Co.

In Ms (601) 856-4121
1-800-443-2667

/AT/XT are tradenames of the IBM Corp.

CIRCLE 324 ON READER SERVICE CARD

The world's number one desktop publishing solution is the only one that spans OS/2, DOS, and Macintosh. And it's the only one that takes full advantage of OS/2 to give you greater power and productivity.

Ask your nearest authorized Aldus dealer about Aldus PageMaker® for OS/2, or call 1-800-333-2538, Dept. 10-K, for our free information packet.

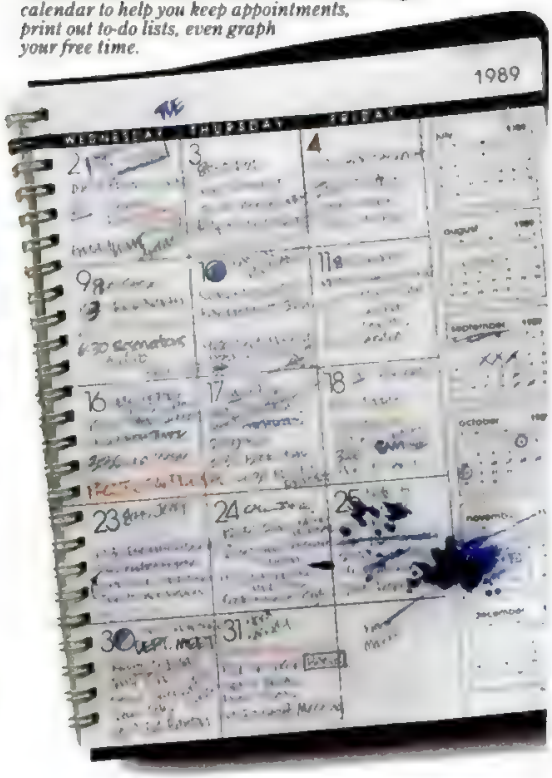
The Creative Edge in Business.

NOW ON OS/2, TOO!

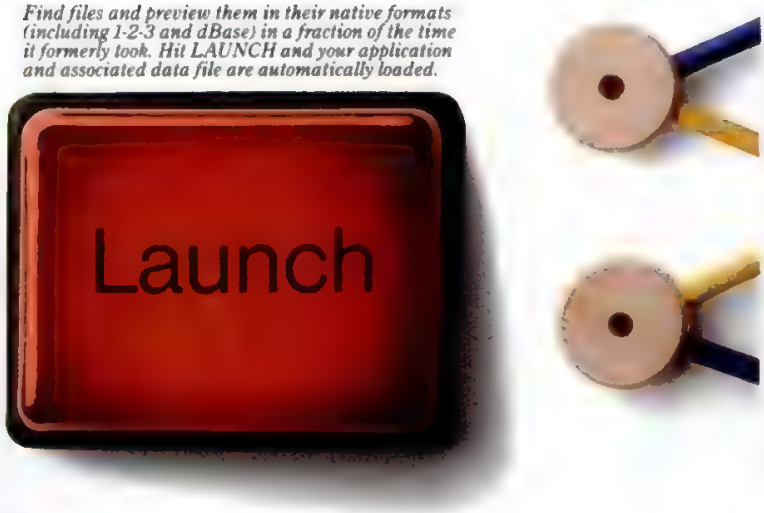
CIRCLE 218 ON READER SERVICE CARD

Many utilities thrive only on misfortune. PC Tools provides first-rate accident insurance plus much more.

Our desktop manager is one of our ***most noteworthy*** *features. It has a word processor,* ***database, autodialer,*** *telecommunications and much more.* ***Including a*** *calendar to help you keep appointments, print out to-do lists, even graph your free time.*



Find files and preview them in their native formats (including 1-2-3 and dBase) in a fraction of the time it formerly took. Hit LAUNCH and your application and associated data file are automatically loaded.



Our clipboard lets you cut information from your spreadsheet and paste it into your word processor (or any other application) without re-entering data or text.

A new visio

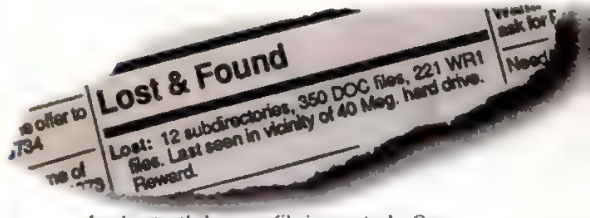
Accidents happen.

And when they do, nobody makes it easier to recover a deleted file or restore a hard disk than PC Tools Deluxe. But Central Point Software believes a utility product should do more than just protect you from misfortune. More than simply back up your hard disk, recover an inadvertently deleted file, or allow you to manage your files from a DOS shell.

Central Point's vision is that a utility product should enhance your productivity every moment you're at the keyboard. It should simplify the way you find, preview and load a 1-2-3 spreadsheet. Make it easy to combine the contents of one document into another. Even allow you to look up a client's address while you're in the middle of another application. Everyday tasks. Tasks that, without PC Tools Deluxe, are difficult to do and take far too much time.

But it's not just what PC Tools Deluxe does that makes it different. Its windowed environment makes doing these things (as well as all of its other functions) simple. The environment's movable, resizable win-

Our PC CACHE can accelerate disk intensive applications dramatically.



Inadvertently losing a file is easy to do. Our UNDELETE makes it just as easy to undo. (Recovers entire subdirectories too.)

Encrypt financial info, employee data, contracts and other sensitive information in a format nobody can crack. Except you.

We can make child's play out of finding and working with files on Novell or IBM Token Ring Networks.

In the event your disk goes up in smoke, PC BACKUP makes sure you won't get burned. It's breathtakingly fast, reliable and extremely easy to use.

n of utilities.

dows, full mouse support, pull-down menus and context sensitive help make learning and using the product a breeze. And PC Tools Deluxe conforms to IBM's Systems Application Architecture (or SAA) standards so its look and feel is almost identical to all the other applications you'll see in the 90s.

PC Tools Deluxe. It has redefined what a utility product should be. Designed not only to protect you from misfortune, but to make using your computer as fast and easy as it should be. So, even if you never have had an accident in your entire life, you'll still benefit from PC Tools the very moment you start using it.

PC Tools Deluxe 5.5

Central Point Software INC.

A MEMBER OF THE VIDEO TECHNOLOGY GROUP ☐ (503) 690-8090

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CIRCLE 212 ON READER SERVICE CARD

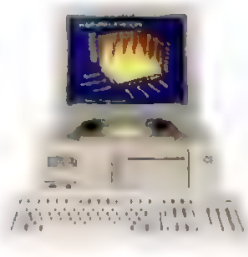
What we do with our 386-based computers is interesting. What you do with them, even more so.

PowerMate 386/25

At NEC, we make machines that run on the purest and most precious of fuels. The human mind.

With these machines you come face-to-face with your dreams. Whether they involve building an ocean-going vessel for that once-in-a-lifetime trip around the world, or something more practical, but just as challenging, like complex financial and scientific modeling.

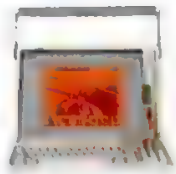
The PowerMate® 386/25 is a high-end desktop computer. Running at 25 MHz, 0 wait states, and with a variety of NEC high-speed disk drives, dreams come true in a hurry with this machine.



PowerMate SX Plus

It's also the perfect network file server.

The PowerMate SX Plus has a 386SX™ CPU that runs at 16 MHz. It ideally positions you to run all of today's 386 software as well as tomorrow's. And it has one of the most popular features in the computer industry: 386 power without the 386 price. Ditto for the PowerMate Portable SX. And being a portable, you can take this machine anywhere your dreams may lead you.



PowerMate Portable SX

As you can see, NEC has certainly done a lot with these machines (you might expect that from a $24 billion world leader in computers and communications). But it doesn't compare to what you'll do with them.

NEC

WE'RE MAKING THINGS BETTER FOR YOU.

NEC Technologies, Inc., 1414 Massachusetts Ave., Boxborough, MA 01719. 1-800-NEC-INFO. In Canada, 1-800-343-4418.

C&C Computers and Communications

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by Gus Venditto

Pipeline

A Look at the Trends Shaping the Personal Computer Market

Innovation Continues in 286 Designs—at Chips and Technologies, Anyway

Experiments in 486 system design are on the front burner at PC manufacturers, but tinkering with 286 PC designs continues, as well.

Chips and Technologies—manufacturer of VLSI logic chips that provide video-, peripheral-, and processor-support functions—is about to introduce yet another optimization of the basic AT design.

Called SCAT (Single Chip AT system controller), this new chip integrates system logic into one component, providing the capability for a PC maker to build a 286 PC with just 14 chips on the motherboard.

The company's last major product for the 286 was the NEAT (New Enhanced AT) chip set, a four-chip design for 12- and 16-MHz clock rates. It was unveiled in 1987 and is still at the heart of some of the most-recent computer introductions, including the Zenith SupersPort 286 and the GRiD Slate.

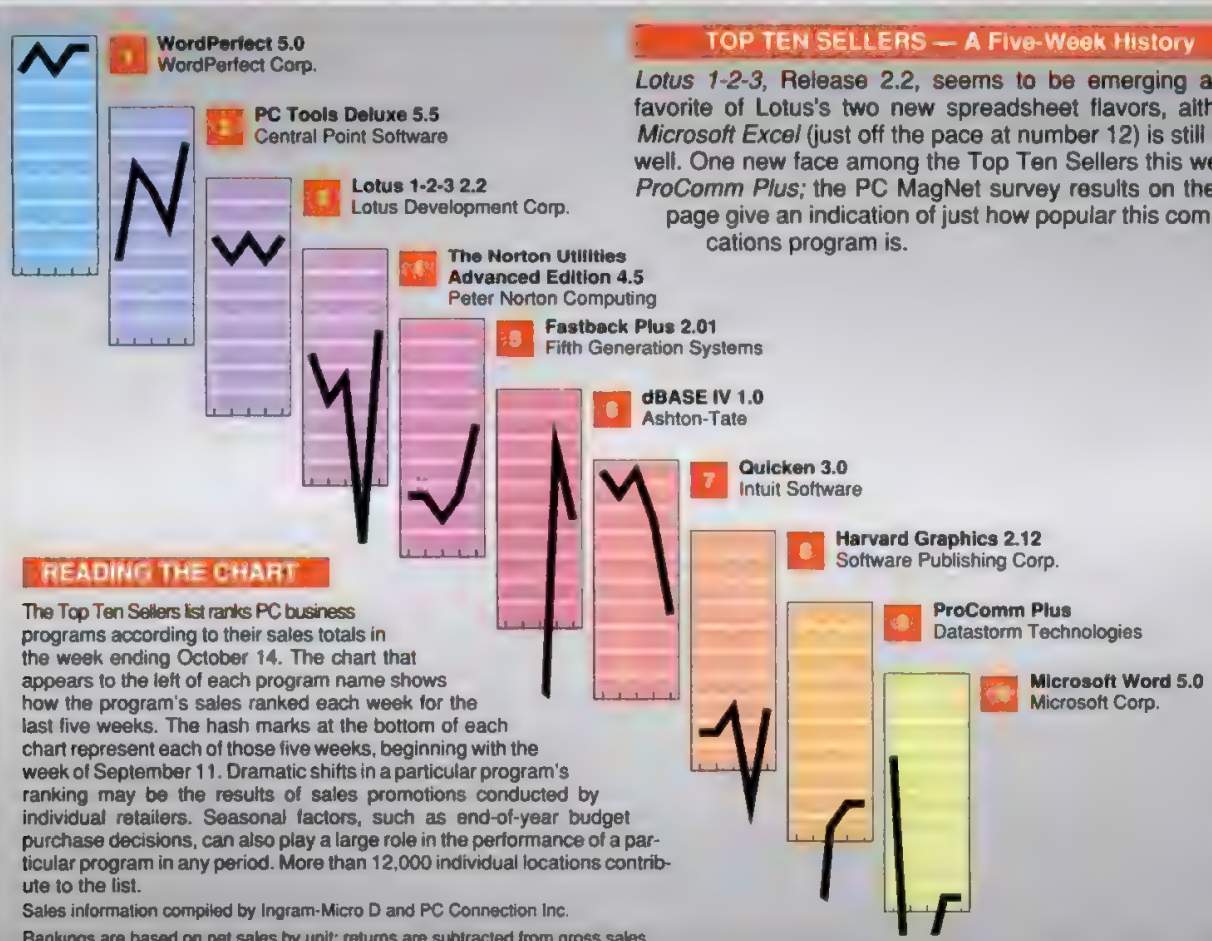
In addition to shrinking the size of the 286 controller, SCAT provides a few innovations geared toward today's software, including LIM EMS 4.0 registers and a fast CPU reset that will help OS/2 move between protected and DOS modes.

Chips and Technologies' chief competitor in system logic is ZyMOS, whose two-chip POACH/AT (PC On A CHip) design is widely used. But ZyMOS has introduced only 386SX and 386 system logic in recent months.

CONTINUES ON PAGE 64

TOP TEN SELLERS — A Five-Week History

Lotus 1-2-3, Release 2.2, seems to be emerging as the favorite of Lotus's two new spreadsheet flavors, although *Microsoft Excel* (just off the pace at number 12) is still doing well. One new face among the Top Ten Sellers this week is *ProComm Plus;* the PC MagNet survey results on the next page give an indication of just how popular this communications program is.



READING THE CHART

The Top Ten Sellers list ranks PC business programs according to their sales totals in the week ending October 14. The chart that appears to the left of each program name shows how the program's sales ranked each week for the last five weeks. The hash marks at the bottom of each chart represent each of those five weeks, beginning with the week of September 11. Dramatic shifts in a particular program's ranking may be the results of sales promotions conducted by individual retailers. Seasonal factors, such as end-of-year budget purchase decisions, can also play a large role in the performance of a particular program in any period. More than 12,000 individual locations contribute to the list.

Sales information compiled by Ingram-Micro D and PC Connection Inc.

Rankings are based on net sales by unit; returns are subtracted from gross sales.

Pipeline

CONTINUED FROM PAGE 63

In explaining his company's continued research in such familiar territory, Chips and Technologies spokesman Gavin Bourne cited studies from InfoCorp. that project 286-based PC sales growing from 5.4 million machines in 1989 to 6 million in 1991.

With SCAT helping to cut manufacturing costs, the 286 is yet another step closer to becoming the processor in entry-level PCs.

486 Still under Development

Eager PC makers have been exceptionally happy to show off early versions of their 486 designs (see First Looks, December 12, 1989, page 33), but they're all going to have to wait for Intel to finish its final testing before putting any products on the market. As of late October, there were still bugs in the chip. The most serious bug is in the floating-point unit, which may corrupt data when rounding a tangent calculation. After fixing these bugs, more testing will be needed. So don't believe any stories about 486 PCs or IBM Power Platforms being on the market until you hear that Intel has officially shipped the processor. IBM may be giving its better customers a sneak preview, but the item is not yet on sale.

DAT Downsizing About To Make Waves

Archive Corp., one of the pioneers of quarter-inch PC tape backup, is about to dramatically raise the profile of DAT 4-mm. tape. The first DAT backup devices have been large affairs with prices approaching $10,000.

A new line that Archive is building and plans to distribute through its Maynard retail brand reduces a DAT's size to that of a typical internal half-height drive and lowers its price to under $5,000. By the end of 1990, you'll probably be able to buy a DAT drive for less than half that figure. The DAT tapes are the same ones used in audio systems and hold about 1,300MB of data.

Earthquake Causes Random Damage in Northern California

Among the consequences of the October earthquake in northern California was the possibility of lingering damage to the PC industry. There's no indication, however, that any company will suffer a long-term setback.

Hewlett-Packard appears to have suffered some of the worst property damage. One of its Palo Alto buildings was destroyed, and others were heavily damaged, disrupting some of HP's chip-production operations. Apple lost a research facility, and Borland lost one of its corporate buildings—but that didn't prevent Borland from setting up phones in the parking lot and keeping shipment of the latest *Quattro* upgrade on schedule.

The saddest loss within the PC industry was the death of two computer journalists, John Anderson and Derek Van Alstyne. Both were on the staff of *MacUser* magazine (a sister publication of *PC Magazine* in the Ziff-Davis family); they were killed when a San Francisco building collapsed.

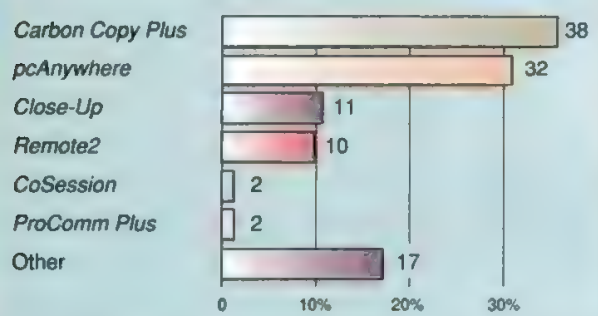
Anderson, 32, was a veteran of two other Ziff-Davis publications, *Creative Computing* and *Computer Shopper*. In the early '80s he wrote a popular column, "Outpost: Atari," in *Creative Computing*, and he had been working on a new on-line project for *MacUser* at the time of his death.

Van Alstyne, 22, had been on the staff of *MacGuide* in Denver and had just recently moved to California to join the staff of *MacUser*. ■

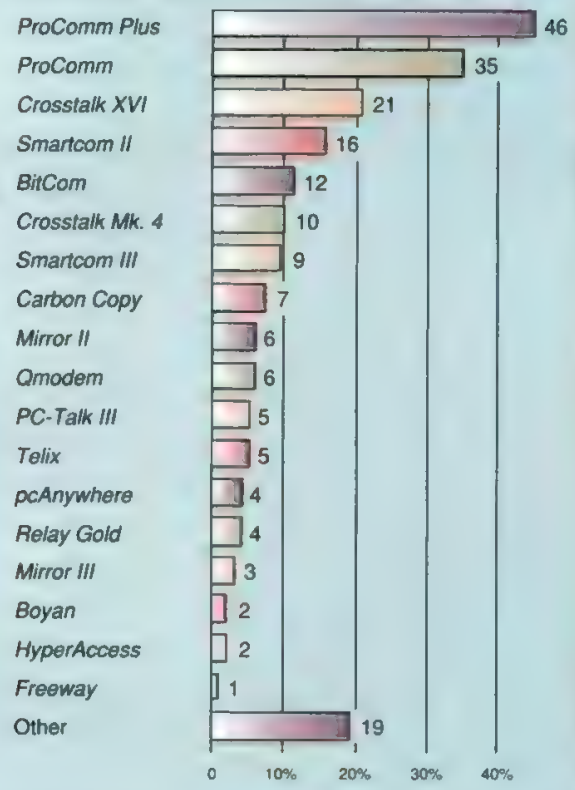
SURVEY

What better place to find communications software users than on PC MagNet? We recently asked them to tell us which program they or their fellow workers used. Clearly, most telecommunicators use more than one program. With its two versions, *ProComm* has an amazingly high penetration.

Which of the following remote-communications programs are used in your office?



Which data-communications software is used at your company?



Some foresight into remote computing hindsight.

Hindsight is always 20/20. And it's always too late. Especially if you've spent a lot of money on remote access software with limited features.

Use some foresight. Compare the features of the various packages up front, and the choice will be clear – pcANYWHERE™ III beats the competition hands down. And you'll never have to look back with regret.

But don't just take our word for it. Publication after publication – including the only Editor's Choice for Remote Computing from *PC Magazine* – have cited pcANYWHERE III as the finest remote computing software on the market today. Bar none. It's faster, easier to use and contains features that just can't be found in any other package.

pcANYWHERE III is also the best solution for remote access to a Local Area Network. In fact, Novell chose pcANYWHERE III for remote computing with its new NetWare Access Server™.

And it's less expensive than other leading packages. pcANYWHERE III retails for only $145. Including the necessary software for both sides – host and remote. You can't duplicate this value at twice the price.

So, go ahead. Compare pcANYWHERE III with other remote access software packages. You'll be convinced that pcANYWHERE III is the right choice for all your remote computing needs – today and tomorrow.

Because foresight is always more productive than hindsight, choose pcANYWHERE III for your remote computing needs.

For more information, or to place an order, visit your computer software dealer. Or call DMA at (212) 687-7115, or write to: DMA, 60 East 42nd St., Suite 1100, New York, NY 10165.

PC MAGAZINE EDITORS CHOICE

DMA

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CIRCLE 330 ON READER SERVICE CARD

New FoxPro

Shifting the Balance Of Power in Database Management

There's a new leader in the relational database management world. Its name is FoxPro.

FoxPro is the first and *only* microcomputer database management system that combines astonishing performance with a sleek interface of amazing power and beauty.

- FoxPro offers all the elegance and accessibility of a graphic-style interface, yet operates at the stunning speeds possible only with character interfaces.
- FoxPro is so easy to learn and use, even beginners can become productive immediately; yet it's powerful and sophisticated enough to satisfy the needs of the most demanding developers and power-users.
- FoxPro gives you choices instead of limits: use a mouse or a keyboard; type commands or use the object-oriented interface; run in one window, or hundreds.
- FoxPro is so efficient, it runs in a 512K PC-XT, yet it's able to take advantage of the speed, expanded memory and extended video modes of the most advanced machines available. You don't even need a graphics card or special windowing software.

Nothing is Faster

Fox Software products are famous for their unmatched execution speed. FoxPro extends that tradition.

FoxPro is up to eight times faster than dBASE IV—more than 15 times faster than dBASE III PLUS!

And that blazing speed translates into unprecedented power. Now you can efficiently process gigantic databases with hundreds of thousands—even *millions*—of records.

Protecting Your Investment

With FoxPro, your existing FoxBASE+ or dBASE III PLUS programs will run perfectly—first time, every time, no excuses. And FoxPro is language-compatible with dBASE IV. But FoxPro doesn't stop there. It has over 140 language enhancements not found in any version of dBASE. We've outdone ourselves by adding more than 200 language extensions you won't find in FoxBASE+.

Best of all, FoxPro opens up whole new worlds for your applications by letting you move them onto a variety of different platforms.

The Tradition Continues

Fox Software is committed to excellence—our products prove it.

We've been producing superb database management software since 1983. And our products for both the PC and the Macintosh continue to win awards worldwide.

We've taken everything we know about software engineering, databases and interface design, and focused it into one remarkable product—FoxPro.

FREE Demo Disk

Shift the balance of power in *your* favor by trying FoxPro for yourself.

Call (419) 874-0162 now to get your free demo disk. Or ask for the FoxPro dealer nearest you. See for yourself: ***Nothing Runs Like The Fox.***

FoxBASE+ Users:
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Upgrade Offer!

System Requirements: *FoxPro operates in 512K RAM (640K recommended) with MS-PC-DOS 2.0 or greater and an 8086/8088, 80286 or 80386 microprocessor. For optimum performance, FoxPro takes complete advantage of any available EMS (expanded memory) or a math coprocessor.*

Trademark/Owner: FoxPro, FoxBASE+/Fox Software; dBASE III PLUS, dBASE IV/ Ashton-Tate.

Fox Software

Nothing Runs Like The Fox.

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CIRCLE 112 ON READER SERVICE CARD

Bill Machrone

Pretending to be all things to all users leaves our industry with a leadership vacuum. We need more vendors willing to stand up and be counted.

Nobody believes in anything anymore. Agnosticism is running wild among the hardware and software vendors.

Microsoft says, "We're not favoring EISA or Micro Channel. We're bus agnostics." Lotus says, "We'll run *1-2-3* wherever it makes sense. We're platform agnostics." Various hardware vendors say, "LAN Manager or Novell? It doesn't matter to us. We're LAN agnostics."

Maybe the turn of phrase is unfortunate, but I call it hedging. Atheists at least have the courage of their convictions. Agnostics hang back, waiting for some blinding proof. This dispassionate intellectualism can be carried to a fault—our industry was founded on advocacy and commitment.

Some of the industry agnostics are merely keeping their options open. They don't want to limit their companies' growth by overcommitting to a platform that may turn out to be in decline. And they certainly want to catch the wave if a hot new platform explodes onto the market.

But the upshot of such agnosticism is user confusion. It's tough enough making decisions about how to spend the company's money without watching the vendors you're counting on for leadership being wishy-washy. It's a lot easier to respect the ones who have an opinion and stand by it.

Whenever you take a strong stance, people invariably come out of the woodwork to disagree with you. Which is OK. You get to test the strength of your convictions. There are, however, those who intentionally misunderstand your point of view, or who take it out of context in order to disagree with it for the sake of disagreeing.

A case in point is *PC Magazine*'s position on 286-based computers. We say they're fine, functional machines that will do a lot of useful, cost-effective computing before their time is through. However, you can buy a 386SX for the same money. We also see a wave of 386-aware software coming down the pike. We see economical 486 computers, especially price-effective for those who require a math coprocessor. So while we'll continue to test and review 286 machines, we won't be making Editor's Choices in that category. In other words, they aren't the kind of machines we'd buy with our own money.

Some of the more passionate voices in the user group community decided to interpret this as a decision to abandon the little people who got us where we are today. Maybe we're not talking to the same little people, but the ones I see are buying 386 machines like hotcakes. They're upgrading their existing machines, and generally doing everything they can to avail themselves of this new technology and to extend their computing power per dollar as far as possible.

WILLFUL IGNORANCE

Some have even chosen to misinterpret massive undertakings like our review of 109 386 machines earlier this year. Syndicated computer columnist and White House correspondent Brit Hume claims that *PC Magazine* has turned its back on the 13 million XT and AT users out there. He sez that we sez that everybody should have a 386 system. He also claims that our enthusiasm for OS/2 is just another contribution to the hype surrounding the product. Hume wants to know why *PC Magazine* is such a willing partner in beating the drum for hardware and software that nobody ostensibly needs or wants.

ILLUSTRATION: WILLIAM CONE

I'll tell you why. When the guys from ALR come by to show us a 486 system for $4,500,

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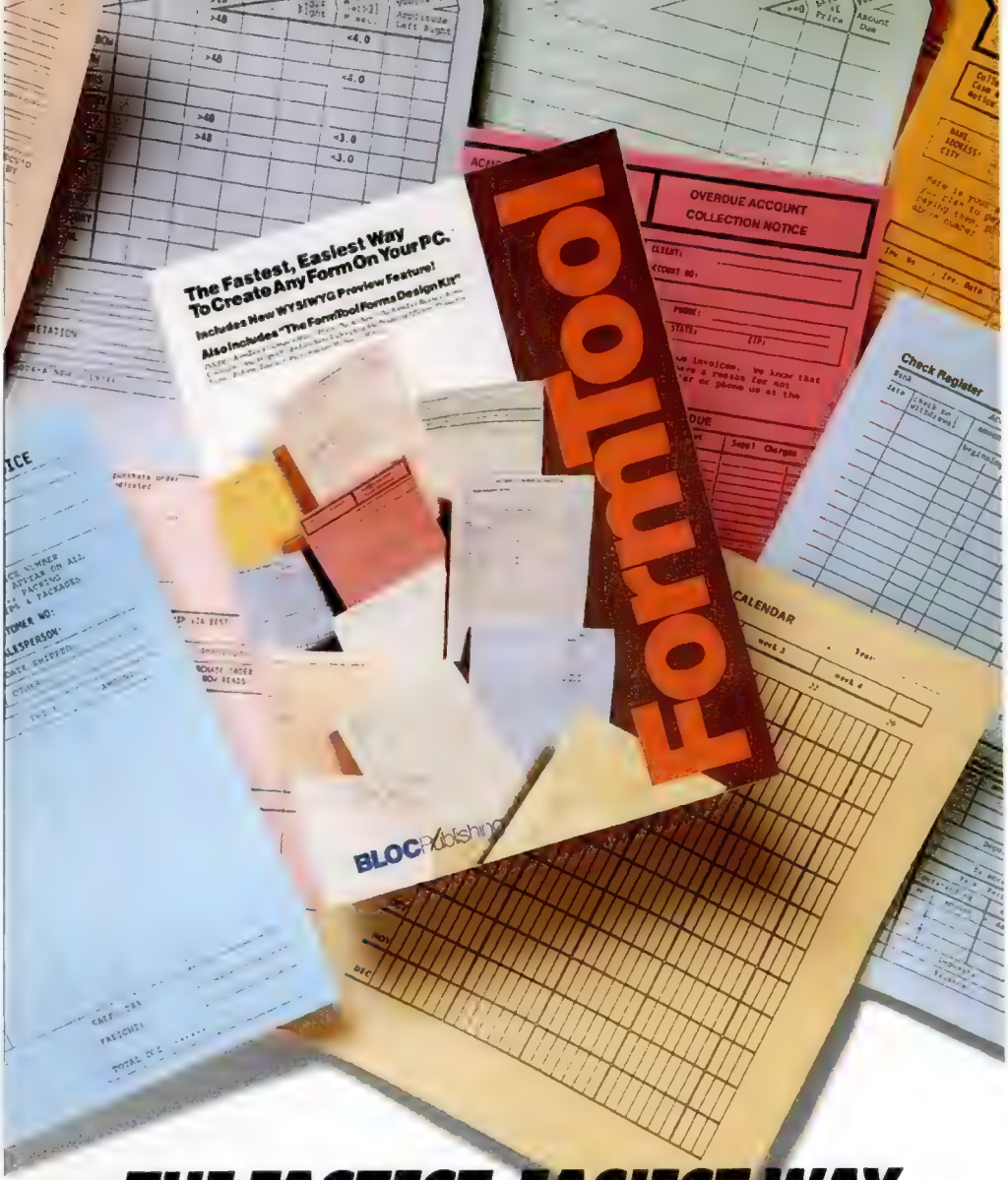

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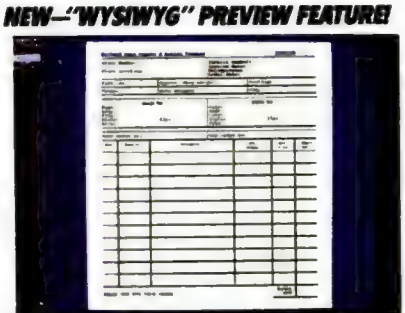

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Bill Machrone

I get excited. When Zeos, Northgate, CompuAdd, and others ship 80386SX machines for the same price as 286 machines, I sit up and take notice. And when Northgate ships a full 32-bit 386 for the same price, I'm floored.

Similarly, *PageMaker* for Presentation Manager crystallizes everything we've been saying about multitasking for the last two years. It's at least twice as fast on equivalent hardware. That's real productivity for the desktop publisher.

Manufacturers tell me that they keep 286 machines in their lines only because of managers who can't reconcile themselves to buying 386 boxes for their secretaries, no matter how inexpensive the machines are. I want to go out and discuss their purchases with each and every one of these people. I want them to get the most computer for their money. I don't want them to be sorry a year from now. But I can't do that. So I do the next best thing—I edit this magazine.

Hume dismisses my observations about hyperchange as hyperhype. Perhaps he hasn't talked to the boggled, beleaguered micro managers who ask me if we couldn't hold off the next round of technological advances until they've had a chance to absorb the last one. As if *PC Magazine* had the power to hold back the tide. As if not reporting about change can prevent it from happening.

WE NEED COMMITMENT

Micro managers would be considerably relieved if some of the major players would drop their agnostic postures and make some clearer statements about direction, performance, and integration. It's no accident that IBM decided years ago that it needed a heftier operating system than DOS to meet its system integration goals. It's no accident that Compaq has committed to fully supporting *LAN Manager*. Its customers know that system integration by the manufacturer is a cure for the pains of trial and error and may be the only way to guarantee system-level performance. This won't stop thousands of VARs and system integrators from using *NetWare*, nor should it. They're believers, and belief generates commitment.

There's no agnosticism here at *PC Magazine*. Believe it. ■

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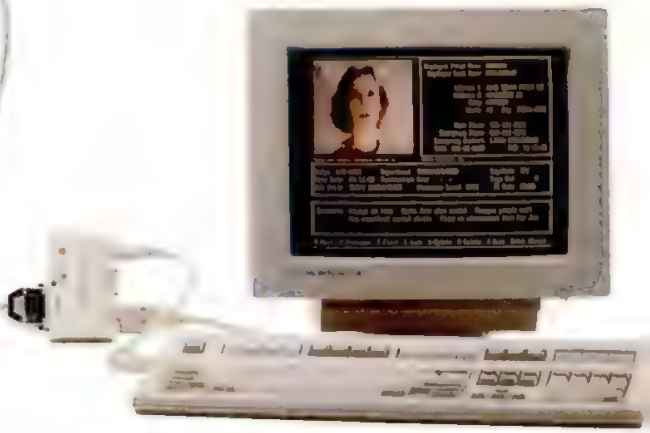

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John C. Dvorak

The computer revolution has made many of life's chores easier to take. But technology worsens some other aspects. Take voice mail, for instance . . .

The biggest plague on the land is the ubiquitous computerized voice mailbox. This obnoxious device is being used by more and more companies to save a few cents, at the risk of annoying customers and, perhaps, ruining their business altogether.

It's funny how people have no qualms about using voice mail nowadays. Many would have cringed years ago if some dopey goof-off employee had hooked an old-fashioned Radio Shack Duophone answering machine to his or her phone line. "I'm screening my calls, Mr. Kelly, that's all."

When I call a company to talk to someone, I want to talk to that person, or to his secretary, or to the guy in the cubicle next door. What I don't want to hear is a voice mail message. Nothing is more abrasive than being unable to get in touch with anyone at a company.

I discovered the other day that one of the magazines I write for has just put in a voice mail system. This is a lulu of an idea for a company that relies on information flow. Sheesh. Every number I called gave me a message. I needed to find out something immediately, but nobody was around. At the end of each message an anonymous voice said, "Recording. Now you may dial star to replay message. One to send message. Two to re-record message. Three to call another voice mail box. Zero to get the operator." So I dialed zero and got a busy tone from which I couldn't recover. Yeah, the receptionist must be so very busy nowadays, too. Hah.

A computerized voice mail system means no accountability. This is bad business. I have rarely gotten a return phone call from a voice mail system. "Hey, Johnny baby. The system lost some of my messages. Are you sure you got the right extension? He he he he."

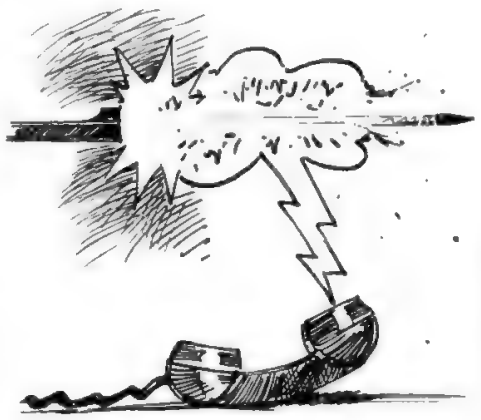
In fact, when I called one large company looking for price data so that I could write about one of the company's products, not only couldn't I find anyone, but two of the voice mail boxes were filled up, so I couldn't even leave a message. Later, I was told that someone had filled up the hard disk with "some large download," so the voice mail system didn't work right for a couple of days.

It's not that receptionists are hard to find or so unionized that you can't fire a lemon or a rude person. So why do companies use voice mail in the first place? It leaves a bad impression with anyone who does business with the firm. *Always.* This means lost sales and ill will. I have never dealt with a voice mail system and felt good about the company afterwards. There is something not only annoying but also terribly offensive about these systems.

THE BRUSH-OFF

Here's the real message that a voice mail system sends. Post it on the wall.

We don't think you, the caller, are important enough to talk to a human being. And our ditzy receptionist is too dumb to take a message. In fact, we are so arrogant that we don't take messages at all. Just leave a message on the voice mail system. Sure, sure, nobody keeps track of this stuff, and if there are too many messages, you may never hear from us. Too bad. Just save us the incredible hassle of actually having to do some work. I mean, pencil lead isn't cheap, and who wants to waste paper? Besides, if anyone were around to take a message, they'd tell you that the person you're trying to contact is in a meeting. We're always in meetings. It's a wonder we do any work. Actually we don't. We're kind of amazed that jerks like you even call us at all. Press pound sign to leave your message. Then pound salt.



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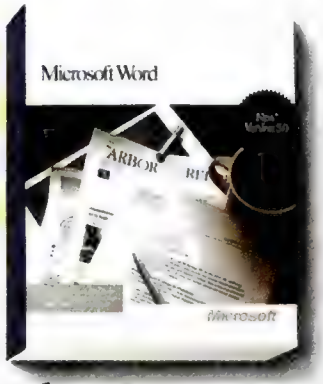
Fine, you say. But this is an *ad.* All of these facts and figures are, well, expected. That's fair. So here's an objective view: Word 5.0 received the best overall rating of any word processing program from two leading publications, *Software Digest* and *Personal Computing.*

To see what they did, call (800) 521-1261, Dept. K11 for a free demo of Microsoft Word 5.0.



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John C.
Dvorak

Inside Track

Hedging Your Bets Dept.: According to Silicon Valley rumormongers, Bill Gates has hired operating-system guru and program designer David Cutler to develop what everyone is calling **Portable OS/2.** This will be generic OS/2, but completely written in C. The idea is that once OS/2 becomes a viable and popular operating system, it will still be confronted by the portability issue.

If RISC becomes as important as many feel it could, then Unix will maintain market share in all the RISC markets, since it is the easiest operating system to port to a new environment once a C compiler has become available. But Portable OS/2 could be **quickly ported to a RISC machine,** too. More importantly for Bill Gates, if the market suddenly collapses or changes direction, he'll still have a fat income. This may be the secret project that finally makes Microsoft the biggest software company in the world.

Gates, meanwhile, has bought **five home sites** adjacent to the home of his right-hand man, Jon Shirley. He intends to tear down whatever's there and build a 40,000-square-foot **lakeside mansion** complete with huge HDTV screens all over the place projecting images of whatever great works of art his "guests" would enjoy seeing.

> You'd think that computers were going to catch the Friday the 13th virus from microbes!

The Untold Story Dept.: As you may recall, there was a hoopla a couple of months ago over the Datacrime or **Friday the 13th virus** that was going to ruin the country somehow. All the major TV networks talked about it. All the newspapers wrote about it. It was on all the radio stations with various "experts" giving their opinions about it. The untold story is that the **media was suckered** into this story by PR mastermind Wes Thomas of East Northport, New York. Thomas, whom I first met when he was promoting some crazy guy named **Captain Sticky,** who continually appeared on "Real People," is one of those rare birds who can still invent a publicity stunt.

Thomas was working on behalf of a virus newsletter and two of the three virus books on the market. By carefully **leaking information** into various channels, Thomas got the attention of the Associated Press—and all the national media—soon after. By the time the networks got hold of the story, you'd have thought computers were going to "catch" this virus from airborne microbes.

It was unbelievable.

Kudos to Thomas for suckering the media. A **double-dart** to the media for not reporting on the publicity stunt aspect of the story, and a **dart** to Thomas, too, for creating a panic.

How Small Will They Go? Dept.: It's amazing: we're now entering the age of the 2-inch hard disk. These minuscule drives pack 20MB to 40MB of storage in a package smaller than a deck of playing cards. Terry Johnson, CEO of PrairieTek Corp., likes to carry a drive in his pocket and show it off whenever he goes out. PrairieTek is the first of a **slew of companies** that will be marketing the 2-inch drives, which are destined to become the mainstay in the laptop arena by this time next year. Also, look for 3.5-inch hard disks with a capacity of **300MB** by June, and with 500MB by December.

Here's a New Twist Dept.: Look for a 2- or 3.5-inch hard drive to come built into the next generation of **laser printers.** All the fonts, forms, and other data will stay inside the laser printer, saving on tedious, time-wasting downloads. This idea was somewhat pioneered by the Apple-Adobe connection. The Apple LaserWriter NTX printer has a hard disk port on the back, and Adobe makes a hard disk that connects to it, putting the entire Adobe type library on-line. **A truly outstanding product.**

Finally, look for the 2-inch hard disk to show up in VCRs, where they will be used for frame buffering, image capture, and special effects. Who said solid state has to replace magnetic media, anyway?

486 Race Dept.: It seems like all the main players in the PC industry are racing to build not only the first shippable 486s, but also the fastest. The 486 is capable of great speeds if the system is correctly designed, and I'm told that this means lots of ASICs (application-specific integrated circuits). An ASIC costs about $30,000 to design, and there are **over 100 silicon foundries** that make them. It's said to be the worst business to be in. Low margins, high pressure.

When Intel gets the **bugs** out of the chip, we'll see a flood of them. Right now, the story goes, the largest cache of 486 chips is right in New York City at PC Labs, where they have been inundated by one-shot prototypes. Believe me, the business will **heat up** when the 486 revolution begins.

Genuinely Interesting Software Dept.: If you do any C programming at all, then you must have a copy of *Clear for C.* At $199, this is the most fantastic utility ever devised for programmers. It creates a variety of **elaborate and accurate** flowcharts from undocumented source code. It's a must for someone working on someone else's code, documented or not documented. Call Clear Software in Brookline, Massachusetts, at (617) 232-4720. There's a version for *dBASE* programs, too! **Outstanding products!** ■

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Much of the credit belongs to Release 3's revolutionary, true three dimensional design. And to its powerful database with DataLens technology that lets you access external data without leaving 1-2-3.

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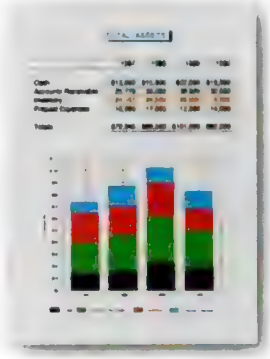

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CIRCLE 293 ON READER SERVICE CARD

Jim Seymour

The catfight over imaging models is more than the stuff of gossip. Because of it, we won't see true WYSIWYG in the PC world for some time to come.

Last time, we looked at how a crisis over disparate imaging models has been splitting the personal computer industry—and hammering the users. Because the ragged evolution of personal computers has allowed the development of many divergent schemes for representing how text will appear on-screen and on paper, we're still far from a WYSIWYG world.

When a given computer uses two different imaging models—one to send a representation of the final output to the screen, a second to send the actual output to a printer—errors are inevitable. While this was acceptable when we lived in a world of character-oriented displays and daisy wheel and dot matrix printers, it is clearly unacceptable in today's era of high-resolution graphics displays and laser printers—particularly with today's graphical applications, which demand far greater accuracy.

Apple's decision last May to build its own system of scalable outline fonts into the Macintosh operating system, in effect dropping its reliance on PostScript, should solve this dilemma for Mac users. In this scheme, the same font outlines would be used both for drawing to the screen and for drawing to a connected printer. And this would provide, at least in theory, an ideal 1:1 correspondence between display and printed output.

But what about PC users? Laser printers using Adobe's PostScript interpreter have drawn good support among DOS applications software vendors. But that only covers the printed-output half of the equation. And Display PostScript is dead in the water as a screen-imaging model in the PC world, for the reasons I traced in last issue's column.

Apple and Microsoft dropped The Big Bomb at Jonathan Seybold's desktop publishing conference in late September. There, Microsoft announced that it would license Apple's scalable-font technology—the same technology going into the Macintosh's System 7.0 operating system next year—for subsequent versions of OS/2 Presentation Manager.

This would let Microsoft build a tight linkage between its own, existing screen-imaging model for Presentation Manager and Apple's scalable fonts. Consequently, users of OS/2 Presentation Manager could be assured that their printed output would match the screen image very closely. And printer makers would be able to build a single model—also based on Apple's font technology—that would work equally well with Macintoshes and PCs running Presentation Manager.

Earlier this year, Microsoft bought the rights to a PostScript clone developed by Bauer Enterprises, and it has cross-licensed that technology to Apple. This no doubt makes Apple a lot more comfortable, after its rupture with its former ally, long-time supplier and once partly owned . . . Adobe Systems.

WHEN ELEPHANTS FIGHT

At Seybold's conference, a nasty dust-up broke out among Microsoft, Adobe, NeXT, and (implicitly) Apple. Microsoft's chairman Bill Gates began the program one morning by fleshing out the details of the Apple-Microsoft deal announced the night before.

Then Adobe founder John Warnock, sitting

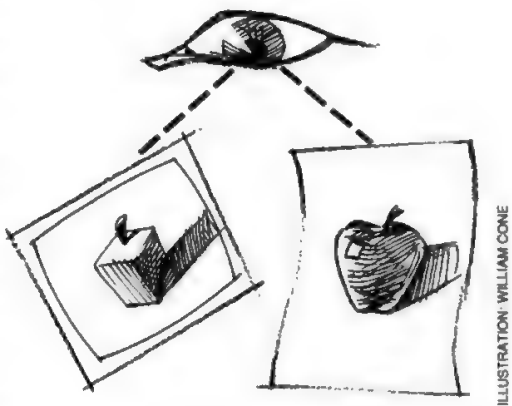

ILLUSTRATION: WILLIAM CONE

on the dais next to Gates, called his plans "the biggest bunch of garbage and mumbo-jumbo I've ever heard." Things went downhill from there: Steve Jobs of NeXT, the sole licensee of Warnock's Display PostScript, was on the dais too and sided, predictably, with Adobe.

Normally this would be only so much soap opera—messier than we're used to but not very important. In practice, though, these four companies, plus IBM, hold the keys to the

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CIRCLE 362 ON READER SERVICE CARD

Jim Seymour

kinds of imaging models that will dominate personal computing for the next decade. So these angry words are more than unseemly: they're tragic. You and I are the real losers in the game of up-yours these five are playing.

What about PC users who aren't interested in OS/2 and its Presentation Manager interface, but who want high-quality scalable fonts built into their operating environment for use in such type-critical programs as *PageMaker*? Will that integral scalable-font technology also appear in *Microsoft Windows*, the graphical environment for determined DOS users?

Peter Neupert, head of OS/2 development at Microsoft, tells me that squeezing that technology into *Windows* will be tough. "One of our design goals for *Windows* is to keep it under 1 megabyte," Neupert says. "Bill [Gates] has said we're going to do these scalable fonts in Presentation Manager first, and we are. You'll see them in PM, then we'll see about *Windows*." Doesn't sound very hopeful.

NOT FOR THE REST OF US

When will the first fruits of this curious Apple-Microsoft alliance appear on dealers' shelves? "We've announced our first 32-bit version of OS/2 for mid-1990," Neupert says. "I don't think there's any chance you'll see the fonts in OS/2 before then. Whether we can move Apple's code into the product in time for that first 32-bit release we still don't know."

The prospect of built-in font outlines—outlines, Apple promises, that will be compatible with PostScript fonts and with fonts from Bitstream, ITC, Linotype, Monotype, URW, AGFA, Compugraphic, and other major type vendors—is vastly appealing. But remember that the Microsoft move still doesn't herald an era with a single, universal imaging model—only one with two very closely related models. Whether close is good enough for the '90s remains to be seen.

The implications for PC users? It's going to be messy. It will take at least two years, Neupert believes, before the imaging-model crisis will begin to be sorted out on PCs—and then, I'd guess, only for users of high-end systems running OS/2 Presentation Manager. For the rest of us, WYSIWYG in the PC world will remain an alluring but distant dream. ■

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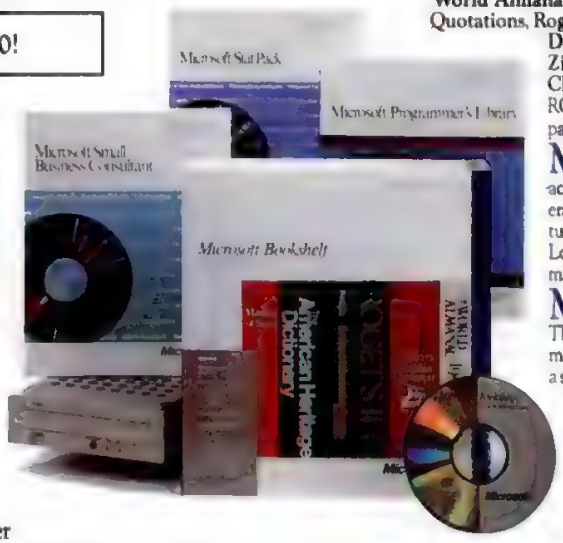

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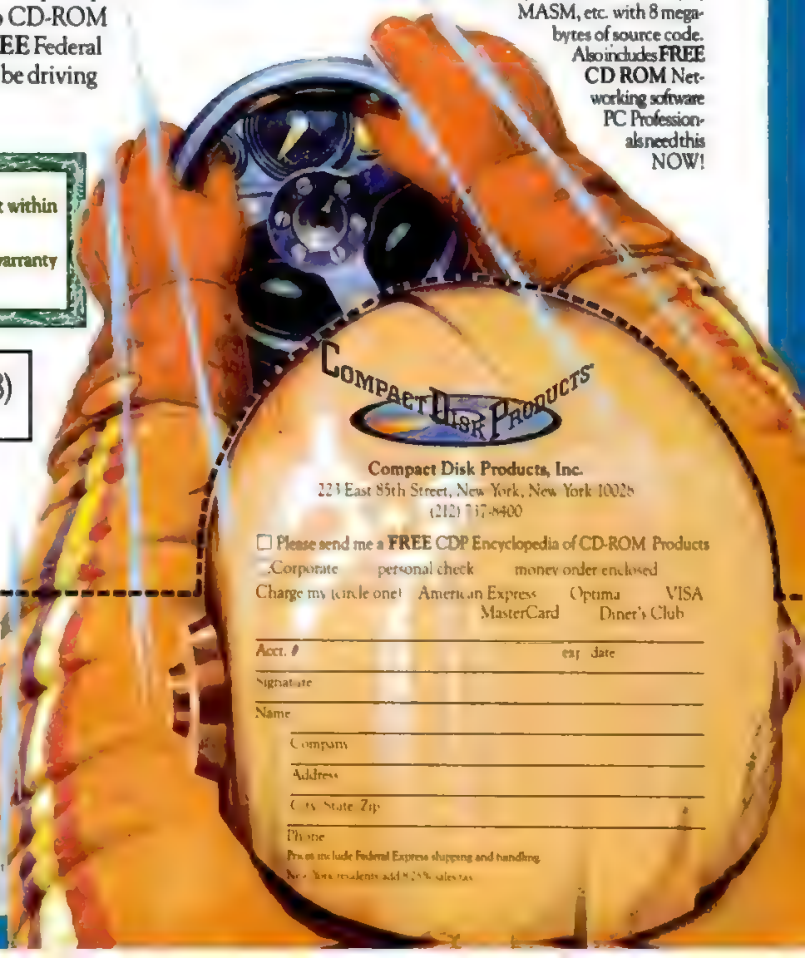

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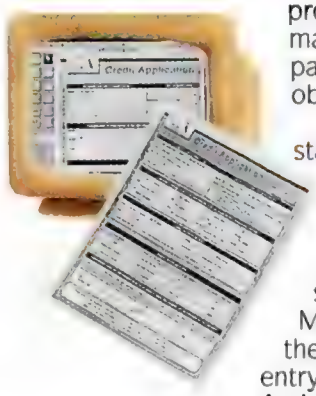

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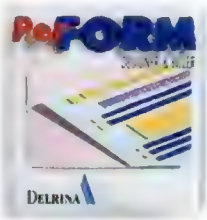

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CIRCLE 250 ON READER SERVICE CARD

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William F. Zachmann

The nineties will be the decade in which the enterprise information system begins to appear. But our methods for building such systems are stuck in the past.

The momentum in the personal computer market that came from the growth of individual productivity applications is now fading. First-time users are no longer the primary customers of PC hardware and software vendors. Today, the more sophisticated buyers of replacement systems represent the best opportunity for future sales.

At the same time, the trend toward the use of microprocessor-based computers as platforms on which to build enterprise information systems is gathering strength. The greatest growth in the early 1990s will come from replacing mainframe and minicomputer systems with microprocessor-based alternatives.

Traditional mainframes and minicomputers, with proprietary architectures unique to their individual vendors, are ultimately doomed. The new systems that will replace them will be built up from the same standardized, readily available components that go into personal computers: microprocessors, small-format Winchester disk drives, laser printers, and so forth. Personal computers, local area networks, and network servers, plus multiuser systems built around one or more standard microprocessors, will be the building blocks for these enterprise-wide systems. And standards will be the mortar that fastens them together.

It's important to remember, however, that making effective use of these flexible new technologies and reaping the dramatically lower costs they can bring with them will not be possible unless we develop new methods for building enterprise systems.

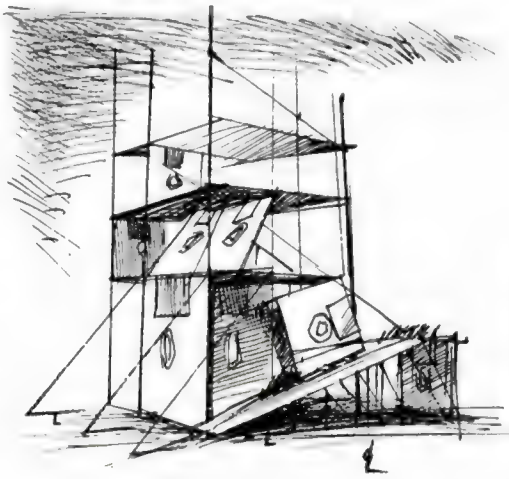
This means more than just creating new development tools, although these too are necessary. More important, we need new ways of thinking, new ways of looking at the problem, and new paradigms of enterprise system architecture and development. Simply applying the traditional product development cycle and other MIS/DP concepts to modern distributed resource systems is insufficient to the task—indeed an active obstacle.

The mainframe development cycle is characterized by a number of well-defined stages. You start with a feasibility study and then proceed to the functional design, detail design, coding, testing, and installation phases. Though individual shops may introduce variations on this sequence, in the end they all amount to the same thing.

What is most important, however, is the final stage: maintain, maintain, maintain. This activity is what sucks up the bulk of programming resources in most larger organizations. Of course, maintenance isn't really just maintenance. It also includes the infinite series of steps in which mistakes and inadequacies in the original design are patched up, in which important functions that were left out in the first place are tacked on, and in which changes needed to respond to changing business conditions are squeezed in.

THE MORE THINGS CHANGE. . .

The advent of structured programming and analysis, better development tools, and, most recently, computer-aided software engineering (CASE) hasn't really changed matters much. The traditional development cycle remains



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the dominant paradigm, even in so-called "new approaches" like IBM's much-touted AD/Cycle. Unfortunately, this paradigm is inadequate, being based on false assumptions about the nature of information and information systems, and their role within the enterprise.

"Information is a resource that should be managed like any other resource in a business." "Information systems should provide executives, managers, and professionals with

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the information needed to do their jobs." "Information systems should be designed to take account of what users want from them."

These are only a few of the conventionally accepted assertions associated with the traditional project development cycle. They are false. Every one of them. And they are seriously misleading in their implications.

First off, information is not a resource like other resources. Information stored on a mainframe is not like cash in the bank or oil in the ground. You need only think a bit about the phrase "yesterday's papers" to gain an understanding of the way information differs from material or financial resources. Information doesn't sit there until it's needed; it's dynamic, and its utility varies with time.

Providing information is not the job of information systems, either. The real output of a corporate information system is not information at all. It is action. The role of the information system of the enterprise is essentially identical to that of the nervous system in the human body. It is to enable the entity in question to act appropriately, so as to be able to survive and thrive in its environment.

The real information system of the enterprise cannot be understood simply in terms of its electronic components. The "brain" of the enterprise information system does not reside solely in the computer room, but in the executive suite and the boardroom as well. It is, in point of fact, an organic/electronic hybrid.

Executives, managers, professionals, and, for that matter, factory workers, store clerks, salespeople, and engineers are not "users" of the information system. They are *parts* of it. They are in fact the most important parts of it. The electronic parts, if designed effectively, merely serve to connect and augment the much more critical organic parts. That's why taking account of what the users want from information systems isn't sufficient. The real issue isn't "what the users want" but what the organization needs.

BEYOND THE OLD PARADIGMS

Developing effective new enterprise information systems isn't just a matter of building new applications. It is a matter of deliberately and consciously evolving what is, for all practical purposes, the nervous system of the enterprise as a whole.

As long as computers were simply grafted onto the organization, acting merely as a sort of electronic appendage largely confined to the computer center, the inherent inadequacies of traditional development methodologies and false underlying assumptions remained manageable. They had their inconvenient aspects, the perpetual maintenance mode being the most important example. But the flaws weren't fatal.

Yet microprocessor-based distributed resources systems are integral to the enterprise in a way that mainframes and minicomputers are not. To be effective, they cannot be bound within the limitations of the traditional product-development paradigm. We need not only new methods, but new ways of thinking, to make them work. ■

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Stephen Manes

It's the end of the year, and our intrepid columnist is overstocked with ideas and notions that never found their way into earlier columns. So he's practically *giving* them away!

Leftover opinions! Unsold insights! They're all discounted to move off the lot here at the Stephen Manes Column's first annual year-end clearance! Act fast and take advantage of our wide selection of compact speculations—all the content of a full-size idea distilled to a few pithy paragraphs. We're eager to clear out our 1989 musings, mutterings, and gripes to make way for the brand-new 1990s, so make your best deal now! Just look at some of these beauties:

■ **A real steal.** Once the hottest of topics, copy protection has withered away, as even the most avaricious diehards have abandoned it. Just a couple of years back, a cadre of the editors of this magazine sat in a hotel room with the minions of a particular vendor and gave them an hour of unmitigated grief about their imbecilic copy protection policy. Eventually the vendor dug deep into what passed for its soul and removed copy protection from its products once and for all.

A couple of months ago a couple of guys from the company waylaid me at a trade show. "We just want to tell you how right you were about copy protection. Thank you."

I was stunned. It may well have been a first. In this business, the usual response to criticism is anything but gratitude. "Our sales are up about 200 percent," the beaming executive went on. "We'd never have believed it if we hadn't seen it for ourselves."

So is copy protection finally extinct? Not on your disk drive! Game programs still use it, or compromise with a dimly inked, hard-to-copy sheet of data, some of which has to be entered before you can play. Misplace the sheet and you're out of luck, but at least you can install the game on your hard disk without worrying about some wacky nonstandard hidden file that destroys your data when you least expect it.

A particularly toasty circle of hell is reserved for the bozos and dimbulbs across the country who keep inventing "foolproof" hardware contraptions to prevent unauthorized access—mostly to programs no one in his right mind would bother with anyway. There seem to be dozens of these schemes, but I hadn't seen one in action lately until somebody sent me a mammoth and vaguely interesting program that came complete with a doohickey that attaches "transparently" to the parallel port (or was that "opaquely").

THEY DIDN'T THINK

You'd think the fact that the software takes half an hour to install would be a major deterrent to theft, but the vendor didn't think. Before I could even touch the program, I had to find a screwdriver and apply it to the back of my machine. Then, after spending 30 fun-filled minutes watching disk drive lights and cryptic on-screen messages, I needed only 10 more to discover the program couldn't do even remotely what it was supposed to. Since the vendor apologized and promised a new set of disks, I blithely left the gizmo in place on the parallel port.

A couple of days later, I turned on my printer and sent a document its way. Alas, the printer had gone deaf to my computer. It took me only 10 minutes of agony to remember that

ILLUSTRATION WILLIAM CONE

the infernal "transparent" copy protection device was still attached. Removing it solved the problem instantly.

The Iron Law of Copy Protection remains: If the program doesn't trust you, don't trust it.

■ **Rustproofing additional.** CD-ROM vendors have long touted the medium's supposed indestructibility. Recent rumors wafting through the industry, however, suggest that the inks used to label the disks can conceivably destroy

Stephen Manes

the reflective coating they're printed on, and thus the disks' readability.

Maybe so. Maybe not. But last spring my friend Wannabee Tycoon used a CD-ROM disk as a Frisbee in an attempt to drive geese from his lakefront lawn. The geese stuck around; the CD-ROM ended up in the drink.

Months later, on a warm midsummer day, Tycoon, with benefit of snorkel, retrieved the disk from the lake bottom—pitted, marred, mottled, its label nearly unreadable. After carefully cleaning and drying the disk, I slipped it into a CD-ROM drive, and—voila!—the system refused even to recognize the disk's existence.

■ **Warranted forever.** In the months after I bought my Kenmore washer and dryer, I could count on an almost weekly mid-dinner phone call about the wonders of the Sears Service Contract. What a wonderful marketing strategy: first, sell the product, and then imply that it's likely to break the minute the warranty runs out! Polite refusals and requests for cessation of the calls failed to deter the intrepid Sears telemarketers; it took a screaming fit worthy of Sam Kinison to do the trick.

AMERICAN KNOW-NOT

In the same spirit of American know-not comes Prodigy, Sears's joint computer venture with IBM. Their PR flacks gave me a complimentary subscription to this on-line so-called "service." I tested it, detested it, wrote mean and nasty things about it, and put it out of my mind.

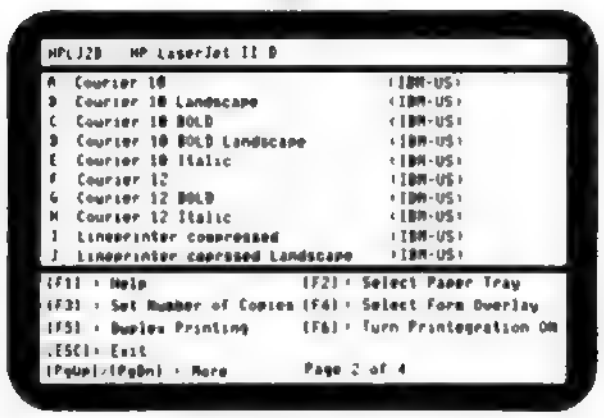
Last spring my friend used a CD-ROM disk as a Frisbee to drive geese from his lakefront lawn.

That is, until the bills started arriving. They now add up to $54.19, which is a whole mess of enchiladas for a service that's basing a lot of its putative appeal on its putative low cost. Prodigy's customer service folks have been every bit as competent as its designers—repeated phone calls explaining the problem have been utterly useless.

And I'm not the only journalist who's run into this problem. So please excuse this Kinisonian rant: *Listen, you turkeys! Account number 2801 10 009 0030581 was a complimentary account! I told you, I told you, and I done told you! I canceled, I canceled, and I recanceled, yet you keep sending these bills! Now get off my case!!*

■ **A pointed rebuttal.** Less than 24 hours after the final version of my column two issues ago, extolling the Isopoint key pointing device, was graven immutably in pixels, a party conversation called the whole thing into question. "You know," said my friend Hardweird, "you seem to have overlooked an advanced pointing interface known to millions of users and gaining a million or so every month. It's so simple every kid in America already knows how to use it. And, dollars to donuts, somebody will eventually adapt it for the PC." With that he reached down to the floor beneath his TV set and picked up his kid's Nintendo game controller. ■

4 Ways To Share Laser Printers



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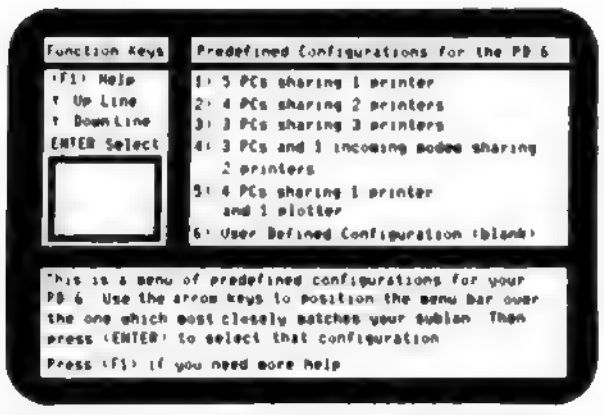

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PC MAGAZINE EDITOR'S CHOICE

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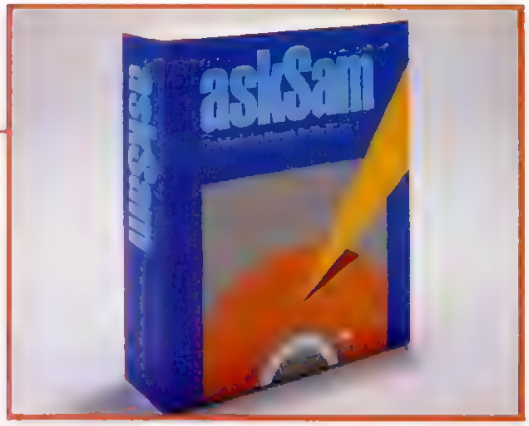

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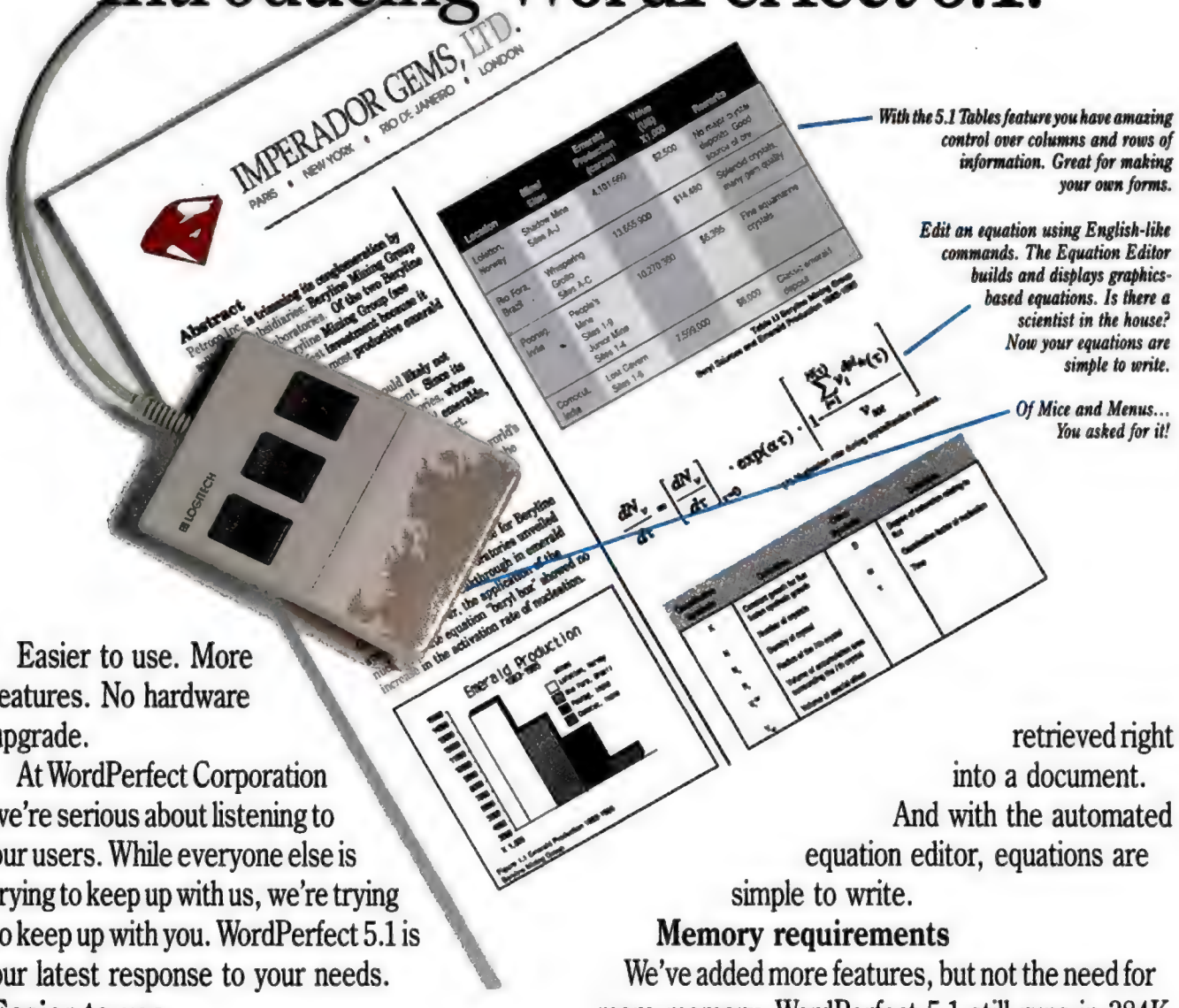

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386/20s Off the Shelf Power at the Right Price

With prices ranging from $2,395 to $2,995, these full-fledged 386/20s offer high performance at a low price. Some compromises . . . but some surprises, too.

by John Dickinson

Just because a candy bar that once cost a nickel now costs 75 cents, it's easy to believe everything costs more these days. But not if you're buying personal computers! The 12 20-MHz 80386-based PCs tested here cost about $2,600 on average, and even less when you include dealer discounts. That's roughly $6,000 less than the price of the original Compaq Deskpro 386/20 when it came out in September 1987, and it's about $2,000 less than the 20-MHz Dell System 310 cost at its introduction in April 1988.

These machines aren't trivial, either. We asked vendors to send us machines equipped with 2MB of RAM, a 40MB hard disk, and a VGA display adapter and monitor. Most of the computers come in large-format, AT-style cabinets, but others, such as the Northgate MicroStation 386/20, have newer, small-footprint desktop configurations with fewer slots. While they're not top-of-the-line PCs by any means, these machines deserve serious consideration from performance-minded users looking for low-cost, entry-level models.

But what is it that makes 20-MHz 386 computers so inexpensive today? Why are these machines up to $6,000 cheaper to produce now than they were a mere two years ago? And even more importantly, are these new computers in the same class as their older and more expensive brethren?

COMPUTER ILLUSTRATION: CHARLES CONOVER
PHOTOGRAPHY: THOM O'CONNOR

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COMPETITION A FACTOR

Competition has certainly made the prices of 386-based PCs go down during the past two years. You can bet, for instance, that Dell's bold pricing of the original System 310 brought the price of the equivalent Compaq or IBM system down. Similarly, more-aggressive vendors underpriced Dell and its peers, and today that same Dell System 310 costs $4,200 with a VGA monitor and 40MB hard disk. The Compaq Deskpro 386/20E, the small-footprint model that replaced the original 386/20, costs $6,100 with built-in VGA.

That explains some of the price difference between the original Compaq and these $2,600 machines. What explains more of the difference is that important technical and marketing factors have created a class of commodity machines based on 20-MHz 386 technology and assembled from standard, readily available parts. You'll want to weigh those factors carefully before considering a high-performance PC that costs as little as these twelve do.

To start with something fundamental as well as simple, the price of Intel's 20-MHz 80386 processor has tumbled from $475 in 1987 to $201 now. In that same period, the "glue" chips required to merge processor, memory, and other discrete components into a functioning PC system board have come down in price by equally large proportions owing to increased production. That price change has affected Compaq's and IBM's pricing just as much as it has affected those of Amax Engineering Corp., C-Squared Microsystems, and other vendors whose machines are reviewed here, so there is no need for concern.

You should be concerned about the performance, construction quality, and service that you'll get with these machines relative to more-expensive models. Performance is one area where PC Labs' benchmark tests will tell you exactly what to think. And 10 of these 12 machines suffer from the lack of a memory cache.

Intel's 20-MHz 386 technology introduced cached memory to the PC industry. While caching was nothing new to mainframes and minicomputers, Intel's 82385 cache controller, combined with 32K of static RAM, brought breathtaking performance to the PCs that use it. A memory cache allows fast memory to serve as a buffer between a fast processor, such as the 20-MHz 386, and lower-speed memory, including 100-nanosecond or slower dynamic RAM chips.

By storing data likely to be needed or recently used by the processor in high-speed (expensive) SRAM, you can have a main system memory made up of slower, less expensive DRAM. Without a processor RAM cache, wait states have to be inserted into memory fetch and store cycles to allow the slower DRAM chips to keep up with processor requests.

KEEPING THE COST DOWN

Like any other performance enhancement, designing and building cache technology adds to the cost of a PC. Eliminating a memory cache is one way to bring down the cost of building a 386-based PC, and ten of the vendors here have done that, resulting in performance for those machines that is roughly 11 percent slower than that of the original Compaq Deskpro 386/20. That's not terrible performance, and many higher-priced machines perform about the same. But you might want to consider the more-expensive machines reviewed here, which offer memory caching and higher performance.

The Intel 20-MHz 80386 processor in these PCs has tumbled from $475 in 1987 to $201. The "glue" chips required to create a system board have dropped by equally large proportions.

Quality is something that is immeasurable; you have to use a machine for six months, a year, or even longer to determine just how long your machine is going to last. Our reviewers report on how well each machine seems to be put together, but remember that to keep costs down, the manufacturer simply has to use less expensive and therefore lower-quality parts.

The key component among these parts is the system board, and vendors that make these and other machines report a wide range of prices. They range from about $300 for a bare-bones, Taiwanese-manufactured board (designed to run without a memory cache) to about $1,300 for a domestically manufactured board with a memory cache *and* with the processor and memory installed. Installing a 386 processor and 2MB of RAM in the Taiwanese board brings its cost up to about $1,000. These system boards include BIOS chips, and once you have the board, all it takes to build one of these machines is to equip it with components compatible with the BIOS.

The rest of the components, such as the video card and monitor, disk controller, floppy and hard disk drives, keyboard, power supply, and cabinet, also have a wide range of prices. While it seems that these vendors pay about the same as vendors of more-expensive machines, a small difference in the price of these components can make a significant quality difference. A 300-watt power supply, for example, doesn't cost substantially more than a 200-watt model, but you may regret having a smaller one if you add a power-hungry expansion board someday.

A small price difference between floppy disk drives can indicate serious differences in reliability. More important, however, is the hard disk, and the disks in these machines differ little in price, performance, and quality from most others on the market. To prove it to yourself, just take a look at the disk performance statistics for these machines compared with the original Compaq Deskpro 386/20 used in PC Labs' benchmark tests. The drives all have access times in the 26- to 32-millisecond range, and their DOS File Access benchmark test scores are quite competitive. On the other hand, the video performances vary by quite a bit, reflecting the quality of the various VGA adapters used in the machines.

WHAT YOU REALLY GET

A larger question is what components will be in the machine you actually buy. Assemblers of PCs like to buy these parts in large quantities and are always on the lookout for the best buys. So, while a machine tested for this review may have a VGA adapter from one vendor, the one you buy may have an adapter built by another. The one you get may be inferior or superior to

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For the features section of this issue, the associate editor was Edward L. Perratore and the project leaders were Bill O'Brien and Pamela J. Milland.

the one tested here, and until you use it, you'll have no way of knowing.

The machines tested here are assembled both domestically and overseas. The most difficult components to manufacture, system boards and disk drives, are purchased by these vendors. The cost of final assembly is relatively small, with the actual place of assembly not being a major concern.

Service is also an area that is hard to measure, but every vendor we talked to while preparing this story said that the biggest factor in holding down its costs is low overhead. This includes advertising costs, manufacturing facility costs, and employee benefits, but it also includes the quality of the manuals you get and the service you'll receive if you have trouble. Some more-expensive machines come with 24-hour support accessible via 800 numbers, one-year on-site service, and other customer benefits that just can't be delivered for $2,600. (Of course, not all expensive machines come with these benefits, either.)

Don't despair, though—there are some pleasant surprises here. Our lowest-priced entry (tied with Tangent), from ACMA Computers, has the stringent FCC Class B rating as proof of its engineering, while the Northgate MicroStation 386/20 comes with all the service and support that has made Northgate Computer Systems one of the leaders in the direct-mail market.

So read these reviews carefully and make sure the machine you select is going to deliver the performance and quality you want. Then call the vendor to ensure that you'll get the level of support you need.

In finding out what the 12 lowest-cost machines actually are, *PC Magazine* contacted 97 computer vendors. To reflect the

CONSOLIDATING THE PC MARKET THE INTEL WAY

by John Dickinson

If Intel had its way, this story wouldn't get published. According to the company's plans for the 386 market, the current 16-MHz 80386SX and the up-and-coming 20-MHz 80386SX processors should be the bases for the entry-level 386 market, not these full-fledged 386/20s. But the market isn't playing it that way—at least not yet.

The 386SX processor offers 32-bit processing with 16-bit memory access and was designed to take over for the older—and less capable—80286 processor. Machines like those reviewed here, however, are priced so attractively that it's hard to imagine why you'd be satisfied with the slower memory performance of an upgraded AT-class machine when you can have the real thing for the same money or less. Even if you decide to spend $1,000 more than the price of one of the machines reviewed here, you'll get better performance for your money in the true 386 market.

But lower-priced SX machines are on deck and ready to come up to bat. After all, Intel's plans really require that you stop buying 286-based PCs; consequently, PC vendors have been responding to Intel's aggressive pricing and marketing moves by building SX-based machines that are becoming price-competitive with 286s. Look for them here in *PC Magazine* next month. Also, expect the number of choices to dwindle in the next year or two as the 286, the 16-MHz 386, and other PC options are consolidated into a likely lineup of 20-MHz 386SXs, 25- and 33-MHz 386s, and 486s. ■

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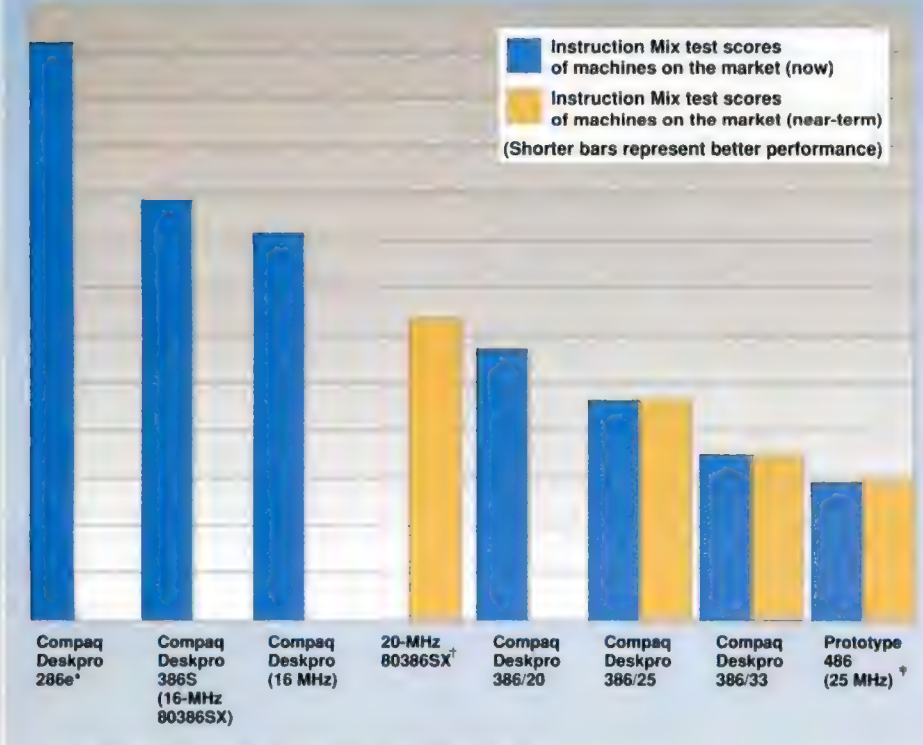

* This result is based on the 80286 Instruction Mix test.
† This result is an estimate based on projections from current PC Labs data.
‡ The Prototype 486 is a 25-MHz 486 machine tested with the PC Labs 80386 Instruction Mix test.

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market accurately, we chose six direct-marketing companies and six dealer-based vendors. Those companies marketing through dealers may offer additional discounts to the prices quoted here, so consult the features table for each vendor's distribution method. The reviews follow alphabetically, while the features table is arranged in ascending price order.

ACMA COMPUTERS INC.

ACMA 386/20 Professional System

by Winn L. Rosch

A quick list of its essentials tells most of the story of the ACMA 386/20 Professional System from ACMA Computers: small footprint, 20 MHz, FCC Class B certification. The smallish system—it measures 5.75 by 17 by 16 inches (HWD)—is a little short on speed, but it does not lack workmanship.

The low $2,395 price of the standard system sacrifices one performance item: a memory cache. The 80-nanosecond DRAM memory is merely interleaved, resulting in performance that brings up the rear among its peers. Included in this configuration is a NEC MultiSync 2A color display with built-in tilt/swivel base. The standard keyboard is manufactured by MaxiSwitch and duplicates the IBM 101-key Enhanced-style layout. DOS is optional: $75 for 3.3, $85 for 4.01. ACMA does not supply OS/2.

The $2,395 ACMA 386/20 Professional System boasts a small footprint—5.75 by 17 by 16 inches (HWD)—and high-quality construction, including neatly dressed wires, good-sized turbo and reset buttons, and room for up to 16MB of 32-bit memory.

PHOTOGRAPHY: THOM O'CONNOR

FACT FILE

ACMA 386/20 Professional System
ACMA Computers Inc., 117 Fourier Ave., Fremont, CA 94539; (800) 666-8898, (415) 438-4400.
List Price: With 2MB RAM, 40MB hard disk, 1.2MB 5.25-inch floppy disk drive, VGA monitor, $2,395. DOS 3.3, $75; DOS 4.01, $85.
In Short: A reduced-footprint model, the ACMA 386/20 Professional System features interleaved memory, four drive bays, good overall construction, and FCC Class B certification.

CIRCLE 420 ON READER SERVICE CARD

The compact chassis doesn't constrain memory capacity. In eight SIP sockets, the ACMA's Helm Engineering (Taiwan) system board holds up to 8MB RAM, with 16MB of 32-bit memory total. In the ACMA's standard configuration, all sockets are filled with 256-kilobit SIPs. While 1-megabit SIPs can also be used, the two sizes cannot be mixed. The SIPs, located at the front end of the expansion slots, may interfere with some full-length expansion boards, and the ACMA 386/20's RAM shadowing puts 384K of the memory total out of the reach of applications.

EXTENDED SETUP

Through the system's extended setup procedure for the eight Chips and Technologies VLSI chips that make up the principal circuitry of the ACMA 386/20, you can program either 8 MHz for compatibility or 10 MHz for a dash of extra performance. A coprocessor socket accommodates either an Intel 80387 or Weitek 3167.

Typical of small-footprint computers, the ACMA lops off inches by shorting you on drive bays. A stack of three half-height bays on the right is complemented by a single vertical one-third-height bay clamped on the left edge of the main bay. All four have front-panel access suitable for removable media.

While the larger bays use standard AT rails—a spare pair are thoughtfully included with the system—the small bay makes mounting a drive Machiavellian. Fitting a 3.5-inch drive can be a trial by tedium, which requires that the entire bay be removed from the chassis to reach two of the screws holding the diminutive drive in place. Power for the four-drive system maximum is supplied by a 200-watt unit from Taiwan Liton Electronic Co.

The $2,395 price of the ACMA includes your choice of a high-density 5.25- or 3.5-inch TEAC floppy disk drive. The 40MB hard disk, made by Seagate, has MFM data encoding and registered a 31-millisecond access time on the PC Labs BIOS Disk Seek benchmark test. Both the floppy and hard disk drive are handled by a National Computer 16-bit combination controller, which supports 1:1 hard disk interleaving.

Three of the four 16-bit slots are filled in the tested unit. A generic 16-bit I/O adapter (that carries all of the system input/output ports—two serial, one parallel, and one game) and an Orchid 16-bit ProDesigner VGA adapter fill the remaining two slots, leaving a total of five slots free: two 8-, one 16-, and two 32-bit for further expansion.

The contents of the setup memory are altered by procedures that are contained, along with diagnostics, in the American Megatrends system BIOS. ACMA also supplies several utilities on disk, including an EMS driver that works in conjunction with the Chips and Technologies chip set to turn extended memory into expanded.

The quality of ACMA's 386/20 is nearly major-league, with neatly dressed wires and fully functioning controls.

With the exception of a poorly fitting keyboard connector, the overall quality of the ACMA 386/20 falls just short of major-league. Wires are neatly dressed. The two large, three-quarter-inch push buttons—turbo and reset—and the three indicators on the 3.5- by 2-inch control panel are attractive and fully functional. ACMA backs its system with a one-year warranty on parts, two years on labor. Unfortunately the documentation attempts to be chatty but fails to communicate vital information about the system. It's vague and at times in error.

Choose the ACMA 386/20 for better-than-average construction quality and its reduced footprint. You'll have to be willing to sacrifice speed, but for $2,395 it's not too big a sacrifice.

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AMAX ENGINEERING CORP.

Amax PC/386-20 Business System

by Alfred Poor

The Amax PC/386-20 comes with documentation in a striking black slipcase that proclaims in bold red script: "No Surprises!" In general the sales slogan fits this $2,750 system well, although you will find a twist or two before you're finished.

The full-size case has a bit more styling on its front than the typical clone, but inside it is a familiar chassis with five half-height drive bays, three of which accept removable media. The case is solidly constructed: instead of the cheaper spot-welding used in less sturdy designs, the mounting cage for expansion card brackets has a continuous weld that joins it securely to the back of the case.

The components in the machine hold few surprises. The disk drives are a Seagate 40MB hard disk and a TEAC 1.2MB floppy disk unit. The 16-bit combination controller is made by National Computer; this isn't as common as the Western Digital card but is a popular choice among the lower-cost machines. The monitor is a Hyundai 14-inch VGA screen with a built-in tilt/swivel base. DOS 3.3 or 4.01 is included in the $2,750 price.

There were few surprises in the machine's performance on the PC Labs benchmark tests. In general, the results were average, with one large exception. The video tests put the Amax near the top of the field. The video adapter was the reason behind this surprise; Amax uses the excellent ATI VGA Wonder card with a bus mouse port built right in. It includes a Microsoft-compatible mouse and works with the genuine Microsoft rodent without problems.

The case holds some other good surprises. One was the presence of labels on all the I/O port connectors. Even better is the FCC sticker on the back: this unit sports a Class B rating, while most competitors offer the less stringent Class A rating. While there are many factors involved in getting the higher rating, it is at least in part a measure of the design and construction quality of the machine.

MIXED MESSAGES

The motherboard came stuffed with 100-nanosecond 256-kilobit chips. The board uses unusual DIP sockets for memory, with offset pairs of rows to accept both 256-kilobit and 1-megabit chips, giving you more flexibility in configuring the system memory. (Now that 1Mb chips are generally cheaper per bit than 256-kilobit chips, this arrangement offers some economic advantages.) The socket arrangement is potentially confounding, though; you'll have to install memory chips carefully to avoid inserting pins into the wrong slots.

Another mixed blessing was the presence of the Chips and Technologies advanced setup utility in ROM. This program lets you reconfigure nearly everything, from bus speeds to memory maps. Amax does make it hard to create a bad configuration, but there are some options where a little fiddling could quickly create an unbootable system. On a more positive note, this utility lets knowledgeable users tune their systems for maximum performance.

A full-size, solidly built box is one of the distinguishing features of the $2,750 Amax PC/386-20 Business System. The mounting cage for the expansion card brackets sports a continuous weld, which securely joins it to the back of the case.

There were even some surprises—ranging from disappointing to downright humorous. The documentation is skimpy at best. There are two thin booklets, on the display adapter and the I/O card, and a 35-page manual covering the motherboard. The motherboard manual is much better than average—it is clearly written and typeset—but it still is too small and leaves out too much important information that novices are likely to need.

The most startling surprise, however, is that the handsome slipcase with the "No Surprises!" emblem also carries the legend "Amax 286 Series User's Guide"; this is sure to unsettle or amuse anyone who expected to find 386 documentation. According to an Amax representative, this misprint is being corrected.

The Amax PC/386-20 ends up running down the center of the road in comparison with the others in the pack. Its price is right about in the middle, along with its performance scores. It has nice features and a few quirks, none of which are enough to swerve it to one side or the other of the value line. It stands as a reasonable if unexciting choice among good values.

FACT FILE

Amax PC/386-20 Business System
Amax Engineering Corp., 47315 Mission Falls Ct., Fremont, CA 94539; (800) 888-AMAX, (415) 651-8886.
List Price: With 2MB RAM, 40MB hard disk, 1.2MB 5.25-inch floppy disk drive, VGA monitor, DOS 3.3 or 4.01, utilities, $2,750.
In Short: The Amax doesn't fully deliver on its promise of "no surprises," but its combination of low price and reasonable performance makes it a solid, low-cost 386.

CIRCLE 421 ON READER SERVICE CARD

BUS COMPUTER SYSTEMS INC.

Bus 386/20

by Winn L. Rosch

Tight budgets and network anchors mix about as well as crude oil and water—with about the same disheartening results. With the Bus 386/20 from Bus Computer Systems, however, you have hope of bringing the desire and reality back together. The system has enough proven reserves to hold sufficient mass storage to anchor almost any network, yet it won't extract a high capital cost.

A tower system that costs just $2,450 in standard trim, the Bus 386/20 delivers a full seven half-height 5.25-inch drive bays in its massive 25- by 7- by 16.5-inch (HWD) confines. With its 20-MHz 80386 microprocessor and interleaved memory, it has enough power for serving almost any need. Included in the system price is an Imtec 1455N VGA display with a 13.5-inch (diagonal) screen. DOS 4.01 ($75)

Copyrighted materia

and OS/2 1.1 ($175) are not included.

The 80386 processor, as well as room for an optional 80387 math coprocessor, resides on a Chicony system board. The Bus 386/20's real personality arises from a combination of its eight major Chips and Technologies VLSI chips and an American Megatrends BIOS. Both setup and diagnostic routines are in the ROM.

System memory fits into eight SIP sockets sprinkled between expansion boards, which run off the 8-MHz expansion bus. Either 256-kilobit chips or one 1Mb chip can be accommodated. A full quota of the former filled out the 2MB RAM of the evaluation system; the motherboard maximum is 8MB. Another 8MB can be crammed into the Bus system's single 32-bit expansion slot to take total capacity up to 16MB.

A full 384K of the system's memory is devoted to ROM shadowing. Although the shadow function can be disabled, this memory cannot be freed up for other uses, according to Bus Computer Systems.

Two 8-bit and five 16-bit slots complete the Bus system's expansion capabilities. Three of these slots are filled in the standard configuration: a generic 8-bit board provides the system's one parallel, one serial, and one game port. Sixteen-bit slots hold the 256K ATI VGA Wonder video adapter and Western Digital disk controller that are included in the $2,450 price.

The latter uses the IDE interface and is matched with a 40MB Western Digital hard disk that delivers good (28-millisecond) performance. The disk performance on PC Labs' benchmark tests was solidly in the middle of the pack.

DISK DRIVE OPTIONS

In addition to the one hard disk, the Western Digital controller will also handle two floppy disk drives. Optional hard disks, available with capacities up to 330MB, require another controller. One Chinon 1.2MB floppy disk drive came in the standard configuration.

You'll find two pairs of internal half-height bays, which will also accommodate full-height devices, in addition to the three half-height drive bays with front-panel ac-

Measuring in at 25 by 7 by 16.5 inches (HWD), the $2,450 Bus 386/20 is a massive tower system that plays host to seven half-height 5.25-inch drive bays. A custom-built keyboard enhances IBM's standard Enhanced-style design with a left-hand double column of 12 function keys that duplicate those on the top row.

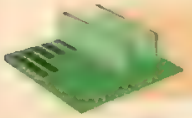
PCs: Why They're Multiplying like Rabbits

by Matt Ross

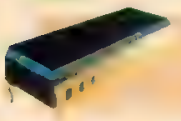
You may have noticed that the number of vendors selling PCs has increased dramatically over the past two years. Largely, this is because quality stock parts have become readily available.

Now that the number of first-source vendors selling these parts has increased, the clone market has exploded. Just about anyone can buy all the necessary parts needed to assemble a competent computer these days. And just about everyone does.

What does it take to build a 386? Here is a grocery list of components from some of the major manufacturers:

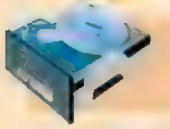


System board
American Megatrends Inc. (AMI), Hauppauge, Micronics, Mylex, Orchid Technology.



BIOS
American Megatrends Inc. (AMI), Award, Phoenix.

Disk controller
Adaptec, Data Processing Technology (DPT), Data Technology Corp. (DTC), Konan Corp., Western Digital.



Hard disk
Connor Peripherals, Control Data Corp. (CDC), Imprimis, Maxtor, Miniscribe, Seagate.

Floppy disk drive
Chinon, Fujitsu, Mitsubishi, Mitsumi, TEAC, Toshiba.

Video adapter
ATI Technologies, Orchid Technology, Renaissance GRX, Video Seven, Western Digital/Paradise.

Power supply
Liton, Kingspao, Power Tronic, Seasonic, Sun Moon Star, Tiger.

Case
Most PC cases are produced in Tawain.

Keyboard
Chicony America, Focus Electronic, Fujitsu, Honeywell, Key Tronic, MaxiSwitch, NMB Technologies' Hi-Tek. ■

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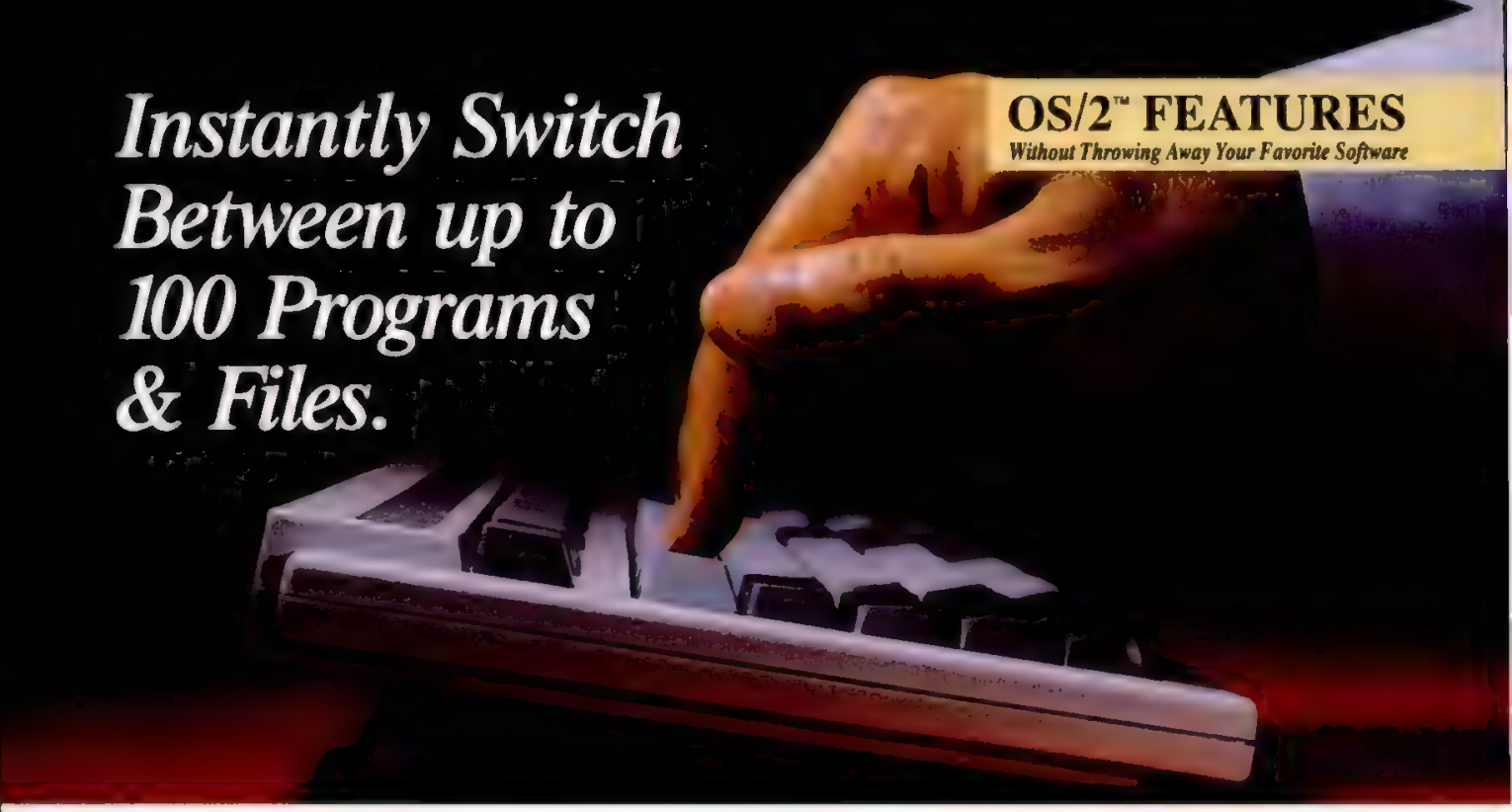

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CIRCLE 106 ON READER SERVICE CARD

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Plymouth, Minnesota 55441-41000
1-800 548 1993

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cess, inside the Bus. One of these drive bays is a tight fit for a full-height drive and difficult to maneuver a drive into. All of the bays require direct mounting of disk drives: just screw them in place. Only if you fill the Bus with half-height devices will you run out of power connections. The 250-watt switchable 115/235-volt ASTEC power supply is wired with connectors for up to six drives.

The Bus Computer keyboard is custom-manufactured using Alps key switches. It further enhances IBM's standard 101-key design with a left-hand double column of 12 function keys that duplicate those on the top row. The keyboard cable, which measures 4 feet when relaxed, stretches to a full 8 feet in length.

FACT FILE

Bus 386/20
Bus Computer Systems Inc., 135 W. 26th St., 8th Fl., New York, NY 10001; (800) 451-5279, (212) 627-4485
List Price: With 2MB RAM, 40MB hard disk, 1.2MB 5.25-inch floppy disk drive, VGA monitor, utilities, $2,450. DOS 4.01, $75; OS/2 1.1, $175.
In Short: A tower-model 80386, the Bus 386/20 offers plenty of mass storage possibilities in its seven half-height disk bays and 250-watt power supply. Marred by mediocre workmanship, it is still blessed with a two-year warranty.

CIRCLE 422 ON READER SERVICE CARD

The Bus chassis is a strong, spot-welded steel frame suitable for any computer, but its workmanship leaves something to be desired. A snarl of wiring convolutes the area in front of the expansion slots; the lower ends of expansion-board retaining brackets are not properly held in place by slots; and the electronics of the control panel, complete with more jumpers than the Pan-American Games, are not fastened at all but only loosely attached by a single connector.

The aura of dubious workmanship of the evaluation system was reinforced by a lack of FCC certification on the case. (According to a spokesperson for Bus, Class B certification is pending for the 386/20 package.) On the other hand, the system is backed with a generous two-year parts-and-labor warranty, which can be complemented with optional on-site service from GE for $250 per year.

Overall, the Bus 386/20 is a messy but workable tower computer with plenty of room for expansion. Choose it when your needs are likely to grow but your budget won't.

C^2 MICROSYSTEMS INC.

C^2 386-20

by Alfred Poor

With a list price of $2,695, the C^2 386-20 falls squarely in the middle of the pack in terms of price. A look inside the system reveals an interesting mix of familiar and unusual features.

You might think that the "C^2" stands for "conservative clone" when you see the roster of components. The hard disk is the standard for this class: a Seagate half-height 40MB drive. The TEAC 5.25-inch 1.2MB floppy disk drive and Taiwanese I/O card are also typical. The disk drives are driven by a National Computer combination controller—a favorite choice among these low-cost clones. The front panel on the case sports the usual keylock, reset, and turbo buttons, and lights for power, turbo, and hard disk access. There are familiar Phoenix BIOS ROM chips, with their distinctive black-on-red labeling, on the motherboard.

Some features are not as typical, however. Instead of some no-name, brown-bag clone display adapter, for example, the C^2 386-20 arrived with an ATI BASIC VGA card. This card does not offer Super VGA 800 by 600 extended resolution, but it is a 16-bit card that yields better performance than 8-bit models. The card was paired with a Tatung 14-inch color screen; this monitor has a switch on the front that allows you to select two special color-text modes in addition to the normal full-color mode. The video system, a reasonable combination, is better than the PC Labs video benchmark test scores indicate.

The C^2 386-20 ($2,695) uses a variety of familiar clone parts, like a Seagate hard disk and TEAC floppy disk drive. Welcome surprises include a 16-bit ATI BASIC VGA card and a bright 13-inch Tatung monitor that offers two special color-text modes besides the normal full-color graphics mode.

Other performance results were equally varied. Processor and memory performance are in the bottom half of the dozen machines reviewed, but not out of the ordinary for a noncached 20-MHz 386 PC. The Seagate hard disk finished with the fastest small-record DOS File Access score and the second-slowest large-record score on the PC Labs hard disk benchmark tests, with its BIOS Disk Seek score being in the middle of the pack.

MOTHERBOARD MEMORY

The motherboard is made by Microcomputer Business Inc. and relies on the Chips and Technologies chip set. It has DIP sockets for memory, but many of these sockets are inconveniently located under the hard disk drive bay. The motherboard can accept either 256-kilobit or 1-megabit chips and can hold up to 10MB in all. The as-tested system had the required 2MB of RAM, and while it is designed to use the slower 100-nanosecond chips, there were both 80- and 100-ns rated chips installed.

The motherboard also has a typical complement of expansion slots, but with an unusual feature. There are a pair of 8-bit slots, five 16-bit slots, and a single proprietary-design 32-bit slot. While most other clone motherboard designs let you use the 32-bit slot for 8-bit cards, the MBI design accepts only the 32-bit memory card. Consequently, unless you expect to install more than 10MB of RAM, this extra slot will just take up empty space inside your case.

The MBI motherboard also has a bank of configuration switches, a feature rarely seen. The designers did make one good decision related to this, however: they silk-screened a table of switch settings right on the motherboard, so that you will not have to search for long-lost documentation if you ever need to change the configuration. That may be a good idea, since there is little other incentive not to lose the system documentation. The manuals arrive in a handsome slipcase and binder set, with the C^2 logo proudly displayed. Open the box and you will find next to nothing. The actual manuals weigh less than 10 ounces, and half of that is a preprinted manual from

LOW-COST 20-MHz 386s: SUMMARY OF FEATURES

(Products listed in ascending price order)

The following commentary analyzes some of the terms in this table of features. The phrases in bold type are listed in the same order as in the left-hand column of the table.

List price For the sake of price comparisons, our standard configuration includes 2MB RAM, a 40MB hard disk, one high-density floppy disk drive, VGA video display, at least one parallel and one serial port, and a keyboard. All 12 of the PCs reviewed here should nearly match these requirements, since this is the configuration *PC Magazine* used to determine the 12 cheapest 386 20-MHz PCs. What each vendor sent to PC Labs is listed as the **tested configuration.**

DOS Note that 8 of the 12 vendors do not include the price of DOS in their standard list price.

Hard disk options The number of different hard disks the vendor offers for a machine is often indicative of how much customizing is available. We are listing what we believe are the most popular disk choices. See **Disk controller manufacturer and type** for an explanation of the interface types.

Disk controller manufacturer and type Within the 386 PC environment, the three most common hard disk interfaces are ST-506, SCSI (small computer system interface), and ESDI (enhanced small device interface). ST-506 uses one of two data encoding methods, RLL (run length limited) and the older MFM (modified frequency modulation) scheme. All data is encoded onto and read from your hard disk as a series of polarity-reversing bits representing ones and zeros. Nine such bits would be needed to store 12 bits of data in MFM format, and only six polarity changes are required with RLL format; thus, MFM takes more space than RLL.

Both SCSI and ESDI require special hard disk controllers and cannot run off existing PC-XT or PC AT controllers. A new interface that offers good performance at a lower price than ESDI or SCSI is IDE (interface design enhancements).

Bus clock speeds Bus speed becomes more important as computers run at faster clock speeds. A computer's bus speed may actually be too fast for expansion cards, most of which operate at 8 MHz.

The **BIOS version and date** may affect PC Labs' benchmark test results. Those purchasing the same machine with a different BIOS version may encounter some variations in performance.

Memory chip size Kb and Mb refer to kilobits and megabits, respectively.

Chip packaging Memory chips come in a variety of styles: DIPs, SIPs, and SIMMs. The dual in-line package (DIP) is the traditional buglike computer chip sprouting 8, 14, 24, or even 40 or more metal legs (evenly divided between right and left sides). Single in-line packages (SIPs) are single-package arrays of

	ACMA 386/20 Professional System	Tangent 320	Computer Market Place Ultra 10-386	Bus 386/20	Northgate MicroStation 386/20
List price	$2,395	$2,395	$2,397	$2,450	$2,549
TESTED CONFIGURATION					
Configuration includes	2MB RAM, 40MB hard disk, 1.2MB floppy disk drive, VGA monitor; 1 serial, 1 parallel, and 1 game port; diagnostics, EMS driver	2MB RAM, 40MB hard disk, 1.2MB floppy disk drive, VGA monitor; 1 serial, 1 parallel, and 1 game port	2MB RAM, 40MB hard disk, 1.2MB floppy disk drive, VGA monitor; 2 serial, 1 parallel, and 1 game port	2MB RAM, 40MB hard disk, 1.2MB floppy disk drive, VGA monitor, 1 serial and 1 parallel port, utilities	2MB RAM, 42MB hard disk, 1.2 or 1.44MB floppy disk drive, VGA monitor, 2 serial and 1 parallel port, GW-BASIC, utilities
Drive bays	3 half-height, 1 one-third height	5 half-height	5 half-height, 1 one-third height	7 half-height	2 half-height, 1 one-third height
DOS	3.3, $75; 4.01, $85	3.3 or 4.01, $88	4.01, $99	4.01, $75	3.3 or 4.01, included
OS/2 available	None	None	None	1.1, $175	1.1, $299
Hard disk options:					
ST-506	65, 80, 120MB	67MB	20, 80, 120, 330MB	60, 80, 120MB	None
ESDI	None	96, 155, 330, 650MB	None	150, 330MB	80, 100MB
SCSI	None	155, 330MB	None	None	80, 100MB
Other	None	None	None	None	70, 100, 150MB (IDE)
Disk controller manufacturer and type	National Computer Ltd., ST-506 (MFM)	Miniscribe, ST-506 (MFM)	Western Digital, ST-506 (MFM)	Western Digital, IDE	Northgate, IDE

—Editor's Choice

computer chip logic assembled so that all connecting legs are in a straight line, like the teeth on a comb. Single in-line memory modules (SIMMs), on the other hand, are individual logic devices that are installed on their own small circuit board, creating a component module that can be plugged into a larger device. Their physical arrangement facilitates replacing an individual memory module if necessary.

RAM chips come in two basic types: static and dynamic. Static RAM chips (SRAMs) are faster and more efficient but costlier. Dynamic RAM chips (DRAMs) cost less and are more common, but the tradeoff is in slower processing and operation.

Interleaved memory CPU speed is usually faster than conventional memory speed. Interleaved memory increases processing speed by splitting the memory into two or more portions. The CPU then sends information to a section at a time, allowing one section to process while another receives data.

Shadow RAM is a technology that loads system BIOS and/or video BIOS directly into fast RAM on boot-up of the computer, offering enhanced performance speed at the cost of 384K of memory in the first 1MB of system RAM.

Disk cache software Some companies provide software to facilitate data retrieval from the hard disk. This software speeds overall system performance by anticipating what data the processor will need next.

Maximum 32-bit RAM Many computer manufacturers have designed their own 32-bit slots for memory expansion cards. The availability of such slots is especially important for a growing number of memory-intensive applications.

A **processor RAM cache** acts as a bridge between the CPU and the slower main memory. The cache is comprised of a small bundle (typically 32K to 128K) of fast SRAM chips. The cache controller is designed to predict and retrieve the data the CPU is likely to require next, thus preventing wait states. There are two varieties of controllers: discrete-logic chips (designed by the individual manufacturers) and VLSI chips like the Intel 82385.

FCC certification class Two classes of FCC (Federal Communications Commission) approval may be given to computers: Class A and Class B. These classes concern levels of radio-frequency interference. With Class A approval, a computer may be operated in a business locale. The tougher Class B rating allows home use as well, where computers are likely to be placed near radios and television sets.

Polysystem MI-Cache-20 $2,650	**Destiny 386-20** $2,649	**Top Gun 386/20** $2,669	**C² 386-20** $2,695	**Amax PC/386-20 Business System** $2,750	**Everest Block 320V** $2,990	**Laser Digital Pacer 386-20** $2,995
2MB RAM, 40MB hard disk, 1.2MB floppy disk drive, VGA monitor; 2 serial, 1 parallel, and 1 game port	2MB RAM, 40MB hard disk, 1.2MB floppy disk drive, VGA monitor, LIM 4.0	2MB RAM, 43MB hard disk, 1.2MB floppy disk drive, VGA monitor, utilities	2MB RAM, 40MB hard disk, 1.2MB floppy disk drive, VGA monitor; 2 serial, 1 parallel, and 1 game port; utilities	2MB RAM, 40MB hard disk, 1.2MB floppy disk drive, VGA monitor; 2 serial, 1 parallel, and 1 game port; utilities, mouse	2MB RAM, 40MB hard disk, 1.2MB floppy disk drive, VGA monitor, 2 serial and 1 parallel port, diagnostics	2MB RAM, 40MB hard disk, 1.2MB floppy disk drive, VGA monitor; 1 serial, 1 parallel, and 1 game port; utilities
5 half-height	5 half-height	5 half-height	5 half-height	5 half-height	3 half-height, 1 one-third height	5 half-height
3.3 or 4.01, $65	3.3, $100; 4.01, $110	3.3, $89; 4.01, $99	3.3 or 4.01, included	3.3 or 4.01, included	4.01, $100	3.3, included
None	None	None	None	None	None	1.1, $120
66, 72, 80, 105MB	20, 30, 60, 80MB	65, 80, 120MB	20, 30, 80, 121MB	20, 80, 120, 180MB	20MB	80MB
105, 150, 318MB	60, 110, 140, 180MB	150MB	158, 339MB	120, 180MB	80MB	150MB
90, 574MB	180, 300MB	120, 150MB	158, 339MB	120, 180MB	100MB	320,700MB
None	None	None	None	None	40MB (IDE)	None
Western Digital, ST-506 (MFM)	Western Digital, ESDI	DTC, ST-506 (MFM)	National Computer Ltd., ST-506 (MFM)	National Computer Ltd., ST-506 (MFM)	Connor, IDE	AMS, ST-506 (MFM)

CONTINUES

LOW-COST 20-MHz 386s: SUMMARY OF FEATURES

(Products listed in ascending price order)

	ACMA 386/20 Professional System	Tangent 320	Computer Market Place Ultra 10-386	Bus 386/20	Northgate MicroStation 386/20
List price	$2,395	$2,395	$2,397	$2,450	$2,549
Number of drives handled by controller	4	3	4	3	4
Disk cache software	■	❑	❑	■	■
Slots	Two 8-bit, four 16-bit, two 32-bit	One 8-bit, five 16-bit, one 32-bit	Two 8-bit, five 16-bit, one 32-bit	Three 8-bit, four 16-bit, one 32-bit	Two 8-bit, three 16-bit
Slots free with hard and floppy drives, video, two serial and one parallel port installed	5	5	5	5	4
Power supply (watts)	200	285	200	250	150
Keyboard cable length (inches)	72	72	84	96	60
Microprocessor clock speeds (MHz)	16, 20	5.32, 6.66, 16, 20	20	16, 20	10, 20
Wait states	0, 1	1, 2	0	0	1
Bus clock speeds (MHz)	8, 10	6, 8, 10	10	8	8
BIOS version and date	AMI 386 BIOS EC&T-1102 (March 1989)	AMI 386 BIOS EC&T-0000 (March 1989)	Phoenix BIOS, Version 1.10.07 (January 1988)	AMI 386 BIOS EC&T-1133 (March 1989)	AMI BIOS DPAQ-6032 (February 1989)
System board manufacturer	Helm Engineering	Data Expert	Micronics	Chicony	Northgate
386 chip set manufacturer	Chips and Technologies	Chips and Technologies	Discrete logic	Chips and Technologies	Northgate
MEMORY SPECIFICATIONS					
Memory chip size	256Kb	256Kb	256Kb	256Kb	256Kb, 1Mb
Memory chip speed	80 ns.	100 ns.	80 ns.	80 ns.	80 ns.
Chip packaging	SIP	SIP	DIP	SIP	SIMM
RAM chips	DRAM	DRAM	DRAM	DRAM	DRAM
Interleaved memory	■	■	❑	■	❑
Shadow RAM	■	■	■	■	❑
Shadowing can be turned off	■	■	■	■	N/A
Maximum 32-bit RAM	16MB	16MB	16MB	16MB	8MB
Maximum RAM on motherboard	8MB	8MB	N/A	8MB	8MB
PROCESSOR RAM CACHE					
Cache size:					
Minimum	N/A	N/A	N/A	N/A	N/A
Maximum	N/A	N/A	N/A	N/A	N/A
Installed	N/A	N/A	N/A	N/A	N/A
Cache memory speed	N/A	N/A	N/A	N/A	N/A
Cache controller	N/A	N/A	N/A	N/A	N/A
OTHER					
Warranty	1 year parts, 2 years labor	1 year	1 year	2 years	1 year on-site
FCC certification class	B	A	A	A	A
Password security	❑	❑	❑	❑	❑
Distributed through dealers or direct	Both	Both	Direct	Direct	Direct

—Editor's Choice ■—Yes ❑—No

N/A—Not applicable: the product does not have this feature.

Polysystem MI-Cache-20	**Destiny 386-20**	**Top Gun 386/20**	**C² 386-20**	**Amax PC/386-20 Business System**	**Everest Block 320V**	**Laser Digital Pacer 386-20**
$2,650	$2,649	$2,669	$2,695	$2,750	$2,990	$2,995
4	4	4	4	4	4	4
❑	❑	❑	■	❑	❑	❑
One 8-bit, six 16-bit, one 32-bit	Two 8-bit, five 16-bit, one 32-bit	Two 8-bit, five 16-bit, one 32-bit	One 8-bit, six 16-bit, one 32-bit	Two 8-bit, five 16-bit, one 32-bit	One 8-bit, five 16-bit, two 32-bit	One 8-bit, five 16-bit, two 32-bit
5	4	4	5	5	4	5
220	200	200	230	200	200	200
84	96	72	75	75	80	66
8, 20	8, 20	8, 20	8, 16, 20	8, 10, 16, 20	8, 20	10, 20
0, 1	0	0	0	0, 1	0, 1	0
8	8, 10	6, 8	8, 10	10	8, 10	6.67, 10
AMI BIOS DAMI-3601 (September 1988)	AMI 386 BIOS EC&T-1109 (April 1989)	Phoenix BIOS, Version 1.10 10 (January 1988)	Phoenix BIOS, Version 1.10 20 (September 1988)	AMI 386 BIOS EC&T-1102 (March 1989)	AMI 386 BIOS EC&T-1153 (March 1989)	AMI 386 BIOS DC&T-4197 (January 1988)
Mylex	Corrado	Micronics	MBI	Amax	CMP	Laser Digital
Chips and Technologies	Chips and Technolgies	Trident	Chips and Technologies	Chips and Technologies	Chips and Technologies	Chips and Technologies
256Kb	256Kb	256Kb, 1Mb	256Kb	256Kb	256Kb, 1Mb	256Kb, 1Mb
100 ns.	80 ns.	70 ns.	80, 100 ns.	100 ns.	80 ns.	100 ns.
SIMM	SIP	DIP	DIP	DIP	SIP	DIP
DRAM	DRAM	DRAM	DRAM	DRAM	DRAM	DRAM
❑	■	❑	■	■	■	■
❑	■	■	■	■	■	■
N/A	■	❑	■	■	■	■
32MB	16MB	16MB	16MB	16MB	16MB	16MB
32MB	8MB	N/A	10MB	8MB	8MB	4MB
64K	N/A	32K	N/A	N/A	N/A	N/A
64K	N/A	64K	N/A	N/A	N/A	N/A
64K	N/A	32K	N/A	N/A	N/A	N/A
25 ns.	N/A	35 ns.	N/A	N/A	N/A	N/A
Mylex	N/A	Intel 82385	N/A	N/A	N/A	N/A
1 year parts, 5 years labor	1 year	1 year	1 year	1 year	1 year	1 year
A	A	B	A	B	A	B
❑	❑	❑	❑	❑	❑	❑
Direct	Dealers	Both	Dealers	Both	Dealers	Dealers

ENDS

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After you ooh-ed and aah-ed over the letter quality output, 3-way paper feed, ease-of-use, 2-year limited warranty, and 9 pin price on our KX-P1124 printer, somebody said, "Great. Now do it with a wide-carriage."

Introducing the Panasonic® KX-P1624. Our newest 24 pin wide carriage printer.

It's fast. Flexible. And fully-featured. Everything most offices are looking for in a dot matrix printer. At a price within most office budgets.

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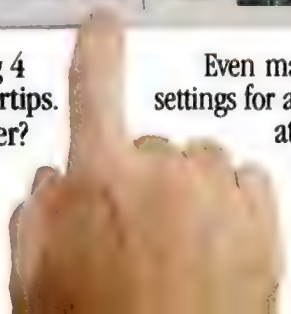
Draft Elite
Courier Pica
Prestige Elite
Bold Proportional Space
Sans Serif Pica
Script Pica

True letter quality, high-resolution graphics, and seven resident fonts, so it's ideal for all your office applications. You'll find the 1624's letter-quality mode as fast, or faster, than most popular 9 pins. Up to 63 LQ characters per second. With its 360 x 360 dpi bit-mapped graphics, you can incorporate special printed effects into your documents. Like company logos and line art.

20 features, including 4 macros, right at your fingertips. What could be simpler?

Even macros that recall all the settings for a particular document at the touch of a single key.



P1-PC

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Done.

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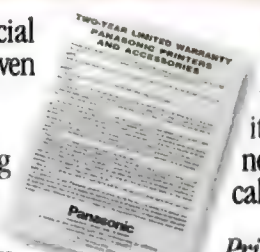
So the 1624 gives you a choice of 4 different paper paths: single sheets from the top, and fanfold from the front, bottom or rear. A special 'Paper Park' feature even lets you feed single sheets from the top, without removing rear-fed fanfold.

Only one paper path is available at any given time for continuous paper.



A 2-year limited warranty in this day and age? That's investment protection, Panasonic-style. You'll find 2-year warranties rather rare in the printer industry. But standard with the Panasonic 1624.

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CIRCLE 138 ON READER SERVICE CARD

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FACT FILE

C^2 386-20
C^2 Microsystems Inc., 1205 Fulton Pl., Fremont, CA 94539; (415) 683-8888.
List Price: With 2MB RAM, 40MB hard disk, 1.2MB 5.25-inch floppy disk drive, VGA monitor, DOS 3.3 or 4.01, utilities, $2,695.
In Short: The C^2 386-20 loses out through poor documentation and awkward system board design features. Unless the C^2 dealers are willing to make up for these shortcomings, there are better bargains to be had elsewhere.

CIRCLE 423 ON READER SERVICE CARD

ATI for the VGA card.

There is no manual for the system as a whole; the closest to one is a thin, 48-page manual that largely diagrams expansion slot pinouts and schematics for the major motherboard components. None of this will be of much use to most users. The remaining "hard" information, such as the "ON BROAD DRAM MAP [*sic*]" leaves much to your own experimentation and problem-solving skills. And important features are not documented at all, such as the hotkey access to the in-ROM setup program.

The C^2 386-20 ends up with little in the way of favorable distinctions aside from its price. Average performance combined with great price are not compelling reasons to accept its flawed documentation and less-than-convenient design features. As this is a dealer-distributed machine, you may get additional support (and discounts, according to C^2) through your dealer. So be certain what support is available.

COMPUTER MARKET PLACE INC.

Computer Market Place Ultra 10-386

by Winn L. Rosch

A computer à la carte is what you get when you order the $2,397 Ultra 10-386 from Computer Market Place. An enticing entrée even at its most ordinary, the Ultra 10-386 gives you a taste of its real potential through a variety of side dishes.

The circuit chef at Computer Market Place knows his ingredients. He starts with a Micronics 386 system board, which operates at an unalterable 20 MHz, and ladles it into the time-proved AT packaging, giving you the gusto of a hearty chassis with five half-height drive bays, all of which offer front-panel access. To suit your personal tastes, you can add either an Intel 80387 or Weitek 3167 numeric coprocessor.

Unfortunately, the $2,397 price of the Ultra 10-386, with its 2MB RAM, 40MB hard disk, and VGA, doesn't include the one ingredient that could make it really savory—memory caching. Adding the cache is a $299 option that substitutes a memory board featuring an Austek A38152 cache controller and 32K of 35-nanosecond SRAM in addition to the 2MB of the standard board. DOS 4.01 is available at $99.

Because the system board is crowded with discrete circuitry (no VLSI for Micronics), there's no room for memory, all of which resides on a single 32-bit expansion board occupying one of the system's eight slots. Maximum 32-bit system memory is 16MB. The base board holds a total of 2MB, as 72 256-kilobit DIP chips rated at 80 nanoseconds. The Ultra 10-386 lets you shadow ROM and video BIOS in faster RAM but gives you the option of disabling this feature.

The remaining two 8-bit and five 16-bit slots operate at 10 MHz. An 8-bit I/O adapter that delivers the system's two serial ports (one with a 9-pin connector, one with a 25-pin), one parallel port, and game port. Two 16-bit slots are given over to video and disk control, leaving four free slots in the tested unit.

MEMORABLE VIDEO

The standard video board is a ProDesigner Plus from Orchid Technology, a high-speed 16-bit board equipped with a full 512K RAM featuring resolutions up to 1,024 by 768 and 256 colors in Super VGA mode. The ProDesigner Plus demonstrates some of the snappiest performance seen in a budget machine, although this still left it significantly slower than the bellweather Compaq Deskpro 386/20. It's complemented by a NEC MultiSync 2A display, although Computer Market Place delivered a 3D for review (a $100 option) because it was out of stock on the lower-priced monitor.

Mass storage includes a TEAC 1.2MB floppy disk drive and a standard Seagate ST-251-1 40MB hard disk. Both are governed by a Western Digital controller card (which supports 1:1 hard disk interleaving). The 200-watt Taiwan Liton Electronic Co. power supply offers two free drive power connectors for future mass storage expansion.

EASY SETUP

The Ultra 10-386 uses the latest Phoenix BIOS, which puts setup just a press of Ctrl-Alt-Esc away no matter what you're doing with your system. No operating system is included in the standard price of Ultra 10-386. If you pay the $99 that Computer Market Place charges for DOS 4.01, however, the system will be delivered with the DOS shell already installed on the system's hard disk. The company does not offer OS/2.

The $2,397 Computer Market Place Ultra 10-386 uses a Micronics 386 system board but locates memory on a 32-bit expansion card. Another slot is filled by the snappy ProDesigner Plus video board, which generates resolutions of up to 1,024 by 768 and 256 colors in Super VGA mode.

Packed with the Ultra 10-386 is an Nan Tan Computer 101-key Enhanced-style keyboard. A free 72-inch extension cable is packed with the keyboard to lengthen its already generous 84-inch cable.

Beside the usual indicators, the front panel of the Ultra 10-386 provides a reset switch and a cylindrical keylock that secures both the case and keyboard. The rear panel include three 25-pin cutouts for adding D-shell connectors. All factory-installed connectors are identified by adhesive labels.

The case of the Ultra 10-386 earns only an FCC Class A certification and the system a B-minus for construction. Although hardly exemplary, it's up to small-shop standards—which means it has the typical snarl of ribbon cable inside.

Computer Market Place extends a one-year warranty to cover its work and the system board; the Orchid video board and NEC monitor bear their own manufactur-

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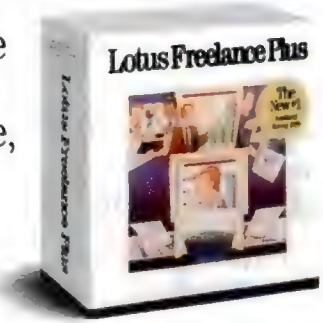

Lotus Freelance Plus

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Computer Market Place Ultra 10-386
Computer Market Place Inc., 511 Abbott Dr., Broomall, PA 19008; (215) 544-8787.
List Price: With 2MB RAM, 40MB hard disk, 1.2MB 5.25-inch floppy disk drive, VGA monitor, $2,397. DOS 4.01, $99.
In Short: The Ultra 10-386 is handicapped with below-average construction, but features in its favor include Orchid's ProDesigner Plus graphics card and high resolutions, including Super VGA and 1,024 by 768 mode.

CIRCLE 424 ON READER SERVICE CARD

ers' warranties (three and two years, respectively). For major failures, the company promises a 48-hour replacement service using overnight couriers. If that still doesn't get you up and running, the company will send a nationally known repair service to your office.

If you don't mind picking and choosing from a menu of add-on components and thereby incurring added cost, you can soup up the Ultra 10-386 into a top performer.

CONTINENTAL TECHNOLOGY INC.
Top Gun 386/20
by Bruce Brown

The phrase *top gun* may make you think of an ace fighter pilot or a proficient gunslinger. As the name for a computer, it might be fitting for a 33-MHz machine, or perhaps for the fastest unit in a vendor's line. In the present case, Continental Technology's Top Gun 386/20 is indeed one of the fastest computers tested in this batch of affordable 20-MHz 386s.

The FCC Class B Top Gun has a typical AT-style case, which measures 6.5 by 21.25 by 16.5 inches (HWD). The $2,669 list price includes 2MB of RAM, one 1.2MB floppy disk drive, a 43MB Toshiba hard disk drive, a 16-bit Trident VGA card, a CTX color VGA monitor bearing a Continental label, and a fine Focus Electronics Enhanced-style keyboard that has a nice clicky feel, a 72-inch cable, and an integral combination dust cover and document holder that is hinged at the top (not shown in photo).

The system price doesn't include I/O ports; a $55 option buys you two serial ports, one parallel port, and a game port. DOS 3.3 is also an option ($89), or you can get DOS 4.01 for $99.

BENEFITS FROM CACHE

Partly because of its 32K RAM cache (included in the price), as well as its 70-nanosecond memory chips, the Top Gun was one of the fastest machines in this group. The processor and conventional memory scores were at the top of the heap. The Micronics motherboard includes a Phoenix ROM BIOS with proprietary 386 circuitry, except for one Chips and Technology chip for DMA management. The processor can be slowed down from the normal 20 MHz to 8 MHz.

The Top Gun's standard 32K of 35-ns. cache memory is upgradeable to 64K for $55; this cache is managed by the Intel 82385 cache-controller chip. Because the RAM cache memory is on the motherboard, there's no room for normal system RAM—all memory is on a proprietary card inserted in the single 32-bit expansion slot. The memory card can take either 256-kilobit or 1-megabit chips. To maximize the system, use 1Mb chips to fill the memory board to its 8MB capacity, then buy a $120 daughterboard that holds an additional 8MB to reach a maximum system total of 16MB of 32-bit memory.

The Top Gun has two 8-bit and five 16-bit expansion slots that can be set to run at either 6 or 8 MHz. In the test configuration, the drive controller and video adapter both were 16-bit cards. The I/O card fills an 8-bit slot, leaving one 8-bit and three 16-bit slots free. To save space for other expansion cards, there are two 25-pin and two 9-pin knockouts for cards that have more ports than will fit in a single slot's rear opening.

You can fit five half-height drives in the Top Gun's case, three of which accept removable media. There are only four power leads from the 200-watt power supply, so if you actually put five drives in the case, use a power splitter. The test machine came with a 25-millisecond 43MB Toshiba MFM hard drive managed by a DTC combination floppy/hard disk controller.

The case has both reset and turbo buttons on its front, as well as indicators for power, hard disk access, and turbo mode.

DIRECT SALES

Most Continental computer systems are sold directly, either by mail order or direct sale, with the remainder being distributed through dealers. All systems include a one-year parts-and-labor warranty.

During the warranty period, Continental will send replacement parts if the defective components can be identified. The company will charge your credit card for the parts and then issue a credit when it receives the defective parts. If you do have to send in the whole system for repairs, Continental promises a five-workday turnaround, including shipping. Continental, a New Jersey–based company, doesn't have on-site service contracts available nationally, but they are available in New York and New Jersey for approximately 10 percent of the system cost per year.

The Top Gun 386/20's fast performance times and low price are enticing. The fact that all the system components are standard items adds to its value as a commodity computer.

The $2,669 price of Continental Technology's Top Gun 386/20 includes a 32K RAM cache as well as 70-nanosecond memory chips, making it one of the faster machines tested. The cache, which is upgradable to 64K, resides on the motherboard; normal system RAM is allocated to a proprietary card that sits in the single 32-bit slot

FACT FILE

Top Gun 386/20
Continental Technology Inc., 300 McGaw Dr., Edison, NJ 08837; (800) USA-CTI1, (201) 225-8899
List Price: With 2MB RAM, 43MB hard disk, 1.2MB 5.25-inch floppy disk drive, VGA monitor, $2,669. DOS 3.3, $89; DOS 4.01, $99.
In Short: By virtue of its 32K RAM cache, Continental Technology's Top Gun 386/20 is one of the fastest of this inexpensive dozen. Otherwise this unit is a fairly typical 386 clone.

CIRCLE 428 ON READER SERVICE CARD

BRIDGES

The *easy* way to move files between the 5¼" world of PCs, and the 3½" world of PS/2s, Laptops, and 386s: Sysgen's Bridge family.

Because your PCs, PS/2s, 386s and laptops all talk to different floppy disk sizes and formats, they can become frustrating *islands* of information.

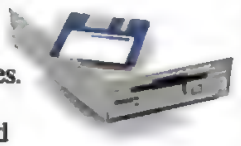
For the simplest way to get files back and forth, just install Sysgen's Bridge products. Presto: Your different computers can talk to common diskettes.

Sysgen pioneered bridges. Now here are three ways to simplify your life in a multi-computer office.

Solution 1: Our Bridge-File 5.25 floppy disk drive.

A best seller, with over 50,000 installed. Attach it to your PS/2, and you can read and write files from PCs. Critics and users alike have raved about its small footprint, ease of use, and dual density capacity of 360Kb and 1.2Mb. (IBM's drive is twice the size, yet stores only one-fourth the data.)

Every PS/2 user deserves this easy connection to the world of PCs.



Solution 2: Our Bridge-File 3.5 floppy disk drive.

You get 720Kb *and* 1.44Mb capacities. Connect it to any PC, and you can read and write files from PS/2s, 386s, laptops, and other 3½" machines.

Now all your PCs can share files with your newer systems.

And here's the ideal controller: The Omni-Bridge Controller.

Controls up to four drives, so you can mix and match 5¼", 3½", and floppy tape drives as you need. This hot card gives you big storage, plus twice the floppy disk and floppy tape transfer performance rates! At only $95, this is a winner.

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CIRCLE 173 ON READER SERVICE CARD

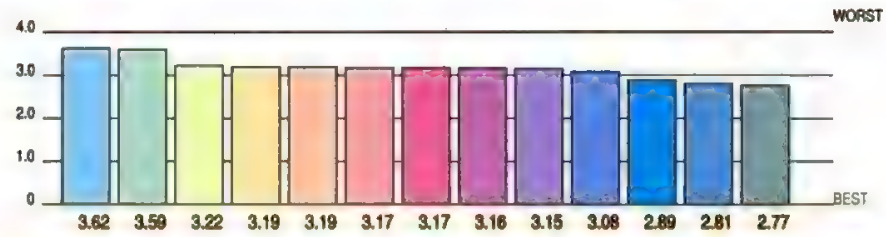
BENCHMARK TESTS: LOW-COST 20-MHz 386s

Continental Technology's Top Gun 386/20 heads this low-cost dozen with four first-place finishes, largely because of the processor RAM cache included in the system's price. For the most part, however, performance differences are minimal owing to the many standard stock parts these systems share.

PROCESSOR AND MEMORY BENCHMARK TESTS

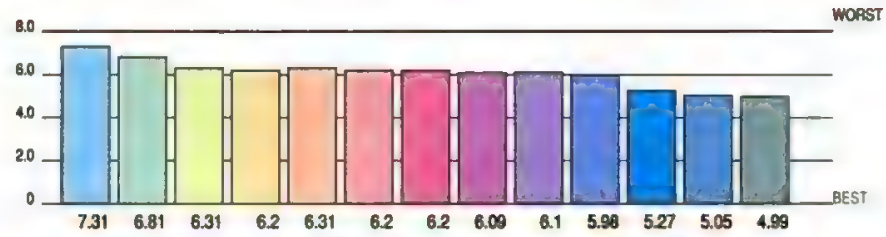
80386 Instruction Mix — Elapsed Time (seconds)

The **80386 Instruction Mix** benchmark test times a series of tasks specific to the 80386 chip. Since this test shows how the CPU operates in the context of the bus, processor, system memory, and motherboard architecture, a faster time means better overall computer performance.



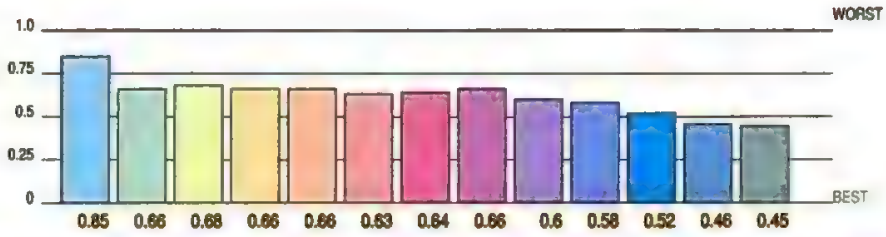
Floating-Point Calculation Without Coprocessor — Elapsed Time (seconds)

The **Floating-Point Calculation Without Coprocessor** benchmark test sets up a floating-point emulation program in RAM and then exercises the processor and tests RAM access speeds during floating-point calculations.



Conventional Memory — Elapsed Time (seconds)

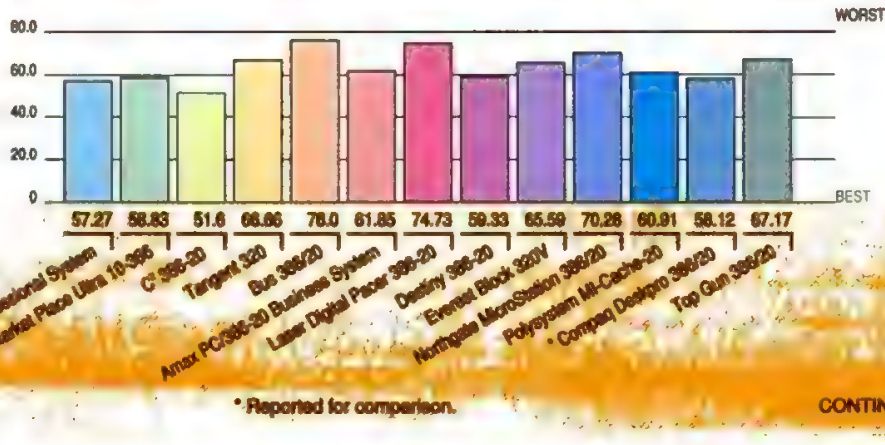
The **Conventional Memory** benchmark test measures the read/write speed of the first 640K of memory. Slower relative times can indicate the presence of memory wait states or memory chips rated at slower access speeds.



DISK BENCHMARK TESTS

DOS File Access (Small Records) — Elapsed Time (seconds)

The **DOS File Access (Small Records)** benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. The test is performed without software disk caching. Fast times are advantageous for programs that work with many short segments of data.



* Reported for comparison.

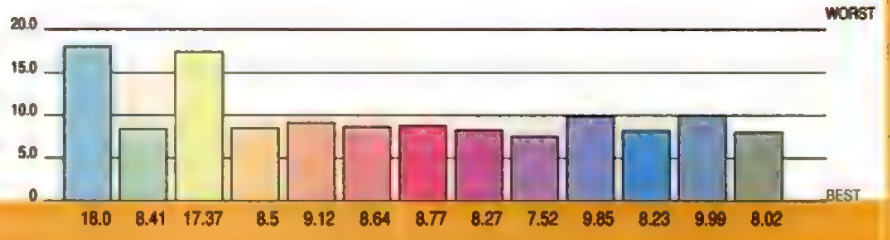
CONTINUES

BENCHMARK TESTS: LOW-COST 20-MHz 386s

DOS File Access (Large Records)

Elapsed Time (seconds)

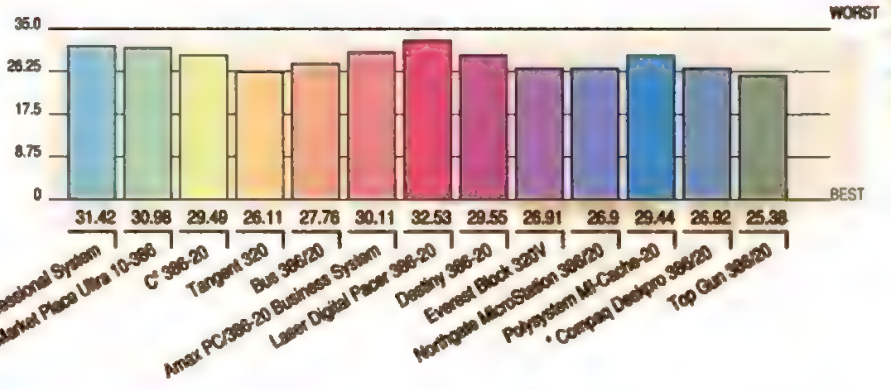
The **DOS File Access (Large Records)** benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. This test minimizes the effect of small hardware caches on disk subsystem performance. It is performed without software disk caching. Fast times are advantageous when large files are loaded.



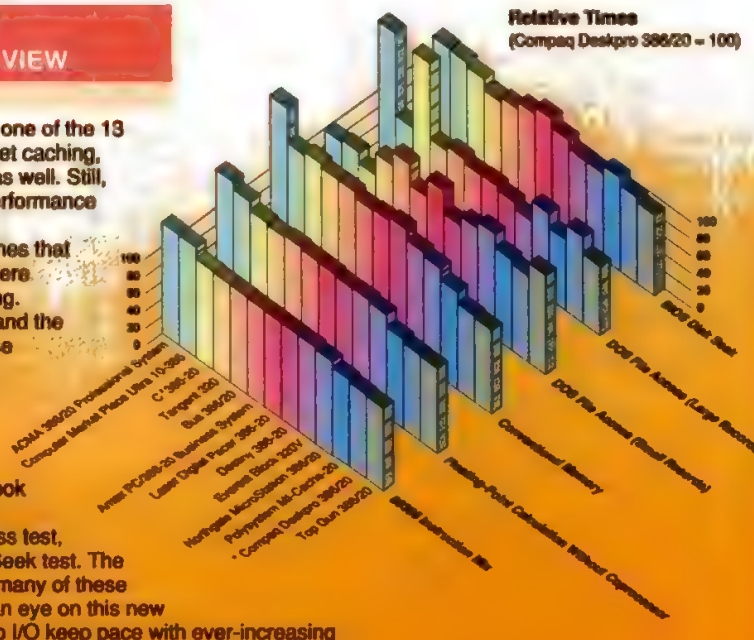
BIOS Disk Seek

Elapsed Time (seconds)

The **BIOS Disk Seek** benchmark test measures mechanical track-to-track disk drive access times. Fast times are helpful with programs such as databases, which often store and must later find data in many separate places on a drive.



PROCESSOR, MEMORY, AND DISK BENCHMARK TESTS: COMPOSITE VIEW



There's more than bang for the buck when you purchase one of the 13 20-MHz 386 computers PC Labs tested. You just might get caching, shadowing, interleaved memory, and a 16-bit VGA card as well. Still, beware of cheap components and the resulting slower performance demonstrated by our benchmark test results.

Our processor and memory tests favor the two machines that include RAM processor caching in the standard price; where caching was an added-cost option, we shut it off for testing. Among the machines we reviewed, the Top Gun 386/20 and the Polysystem MI-Cache-20 placed first and second on these tests, sandwiching our reference standard, the Compaq Deskpro 386/20. In last place, the ACMA 386/20 Professional System uses 80-ns. DRAM chips with 1:1 interleaving, but this is not enough muscle to compete with built-in RAM caching.

Disk I/O results varied. The C² 386-20, for instance, took top prize for the small-record DOS File Access test; the Everest Block 320V won the large-record DOS File Access test, and the Top Gun 386/20 finished first on the BIOS Disk Seek test. The C² uses MFM encoding with the ST-506 interface, as do many of these systems; the Everest uses the new IDE interface. Keep an eye on this new interface: it's one of several hitting the market now to help I/O keep pace with ever-increasing processor speeds.

Interfaces alone don't tell the whole story: the ACMA 386/20, using the same IDE interface teamed with a slower hard disk, suffered a last-place finish. Should the dreaded "I/O bottleneck" be a concern, consider purchasing a faster hard disk or disk-caching software, which helped the C² 386-20 achieve its one first-place finish.

* Reported for comparison.

CONTINUES

Before you make any big decisions over which laser printer to buy, we'd like to point out a few little things about the new Canon LBP-4.

The first of which is size. Unlike most "desktop" printers that need a space the size of a football field to fit in your office, the LBP-4 is compact. So it actually fits on top of your desk.

It also fits your budget. With an equally compact price of only $1,545.*

And it's the only laser printer in its class to offer built-in scalable fonts that let you set type from the smallest fine print to headline size. Without options or add-ons.

Plus a lot of other little extras that make it easy to print high-quality text and graphics right down to the smallest detail. Including Canon's convenient EP-L replaceable cartridge, and a versatile front-loading paper tray. It even prints envelopes.

So call toll-free 1-800-441-5454 or stop by your Canon Dealer and see an LBP-4 for yourself.

Very little to get

It's the first compact, affordable laser printer with scalable fonts, standard. And that's something to get excited about.

A printer driver kit is provided free with each new LBP-4 containing all printer definition files currently available for this printer on diskette, plus complete installation instructions.

*Manufacturer's suggested retail price.

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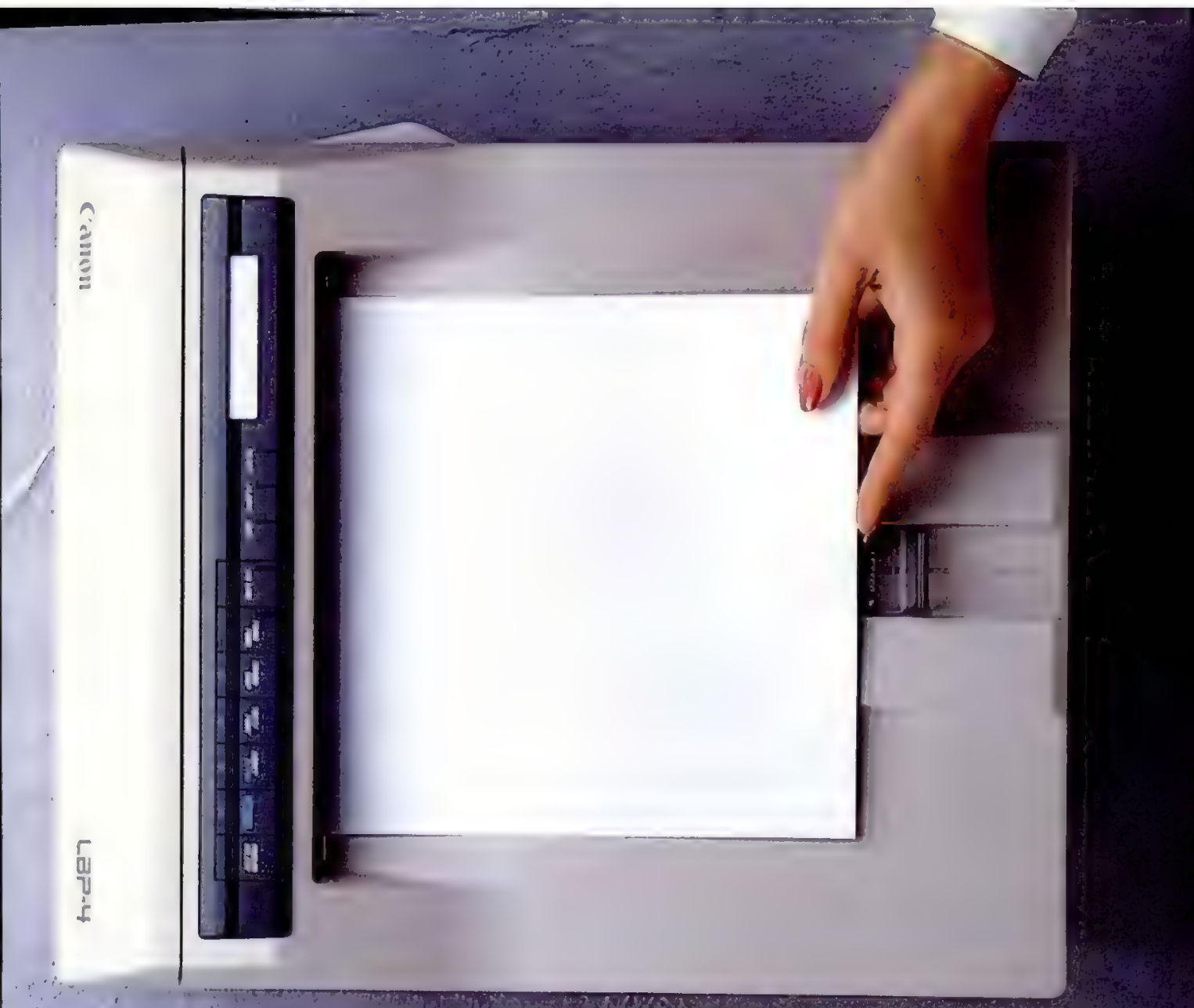

excited about.

Canon

LBP-4

LASER BEAM PRINTER

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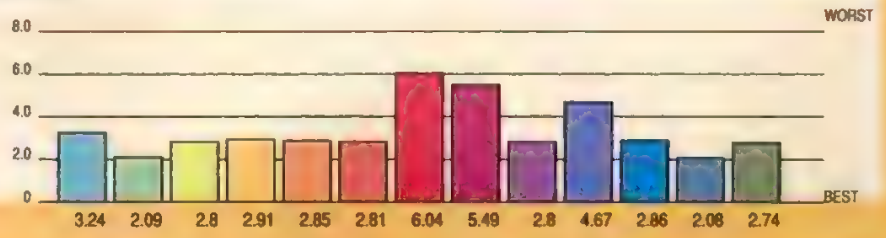
CIRCLE 471 ON READER SERVICE CARD

BENCHMARK TESTS: LOW-COST 20-MHz 386s

VIDEO BENCHMARK TESTS

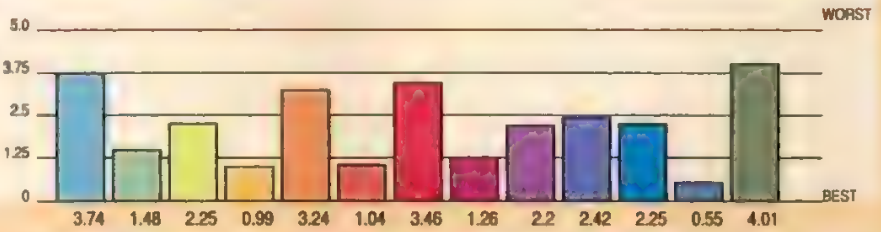
Direct to Screen — Elapsed Time (seconds)

The **Direct to Screen** benchmark test indicates the speed of the video adapter memory. Good scores indicate that information can get to the screen quickly, particularly for programs that avoid the computer's BIOS and go directly to the screen.



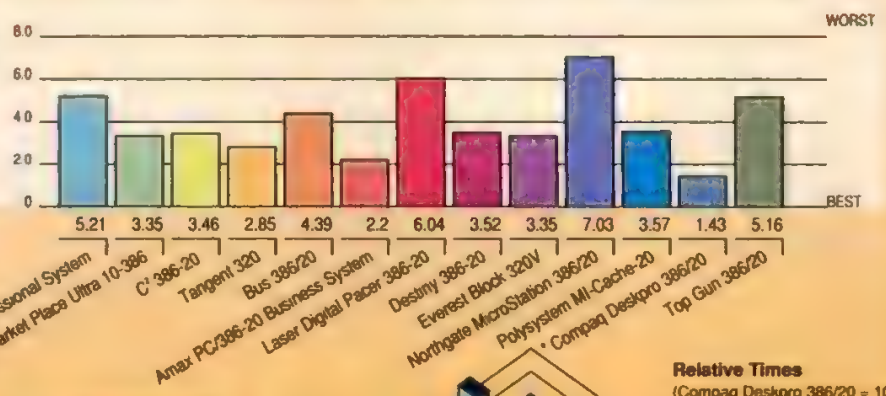
Video BIOS Routine Without Scrolling — Elapsed Time (seconds)

The **Video BIOS Routine Without Scrolling** benchmark test measures how quickly the BIOS on the video adapter writes text data to the screen. Fast video writing helps with programs that show full or partial screens of data without scrolling the screen.

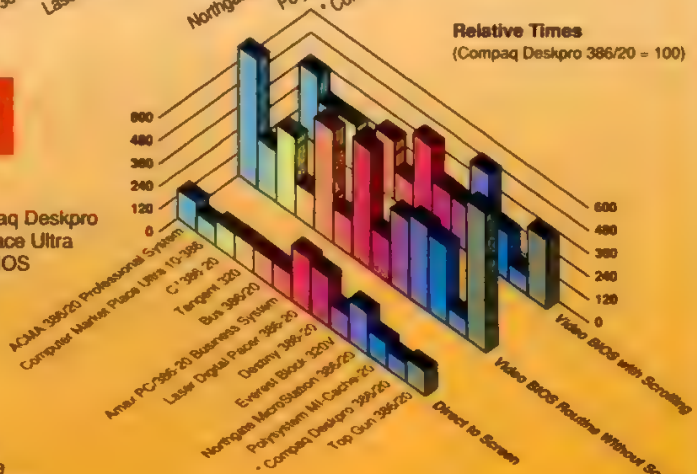


Video BIOS with Scrolling — Elapsed Time (seconds)

The Video BIOS Routine with Scrolling benchmark test measures how fast the video adapter can scroll the screen, moving the display up one line at a time. Good performance is helpful for scrolling through word processing or spreadsheet files.



VIDEO BENCHMARK TESTS: COMPOSITE VIEW



None of the tested machines matched the video speed of the Compaq Deskpro 386/20. It was most closely approached by the Computer Market Place Ultra 10-386 on the Direct to Screen test, by the Tangent 320 on Video BIOS Without Scrolling, and by the Amax PC/386-20 Business System on BIOS with Scrolling. All three have 16-bit video adapters. The Ultra uses a Western Digital VGA board, while Tangent has a Video Seven and Amax opted for an ATI VGA Wonder. You should always try for a 16-bit board manufactured by one of the top performers in this area, especially if you are involved with graphics applications.

Note that the new Compaq Deskpro 386/20E incorporates 16-bit VGA circuitry into the system board for even faster performance. We tested the older Deskpro 386/20, which uses a Compaq 16-bit VGA card fitted with the Paradise PVGA chip set.

* Reported for comparison.

ENDS

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DESTINY COMPUTERS

Destiny 386-20

by Stephanie Izarek

In order to stake a claim in a market densely populated with similarly designed 386 machines, computer manufacturers must look to unique areas outside of pricing, speed, and quality design. Destiny Computers has done just that by capitalizing on its ability to meet virtually any configuration request made by a dealer and using quality, name-brand components to do so.

With this philosophy in mind, Destiny is introducing its new D-series line of 386 machines, built around the Corrado motherboard, with the Destiny 386-20 ($2,649). This sturdy, FCC Class A desktop model, capable of holding five half-height drives, comes equipped with a 40MB ESDI Seagate hard disk, a 1.2MB 5.25-inch floppy disk drive, a Western Digital controller card, a Super VGA graphics adapter, and a 200-watt Soletek power supply. Included in the list price is a Casper 14-inch VGA monitor, with a high-resolution, nonglare screen, and a well-crafted BTC 101-key keyboard with sculptured keys and extra spring. DOS 3.3 must be purchased at an additional $100, and OS/2 is not yet available.

The Destiny also offers the convenience of front-panel power-on and reset controls, along with Turbo speed, hard disk, and power-on LED indicators. (Note: you'll especially appreciate the reset button's quick results after you spend what seems like half a day waiting for the warm boot executed from the keyboard to take effect.)

The Corrado motherboard is at the heart of the $2,649 Destiny 386-20; the system board features Chips and Technologies' VLSI chip set and AMI's BIOS, as well as the ability to hold up to 8MB of 32-bit RAM.

FACT FILE

Destiny 386-20
Destiny Computers, 754 Whitney St., San Leandro, CA 94577; (800) 366-4272, (415) 430-8810.
List Price: With 2MB RAM, 40MB hard disk, 1.2MB 5.25-inch floppy disk drive, VGA monitor, $2,649. DOS 3.3, $100; DOS 4.01, $110.
In Short: The Destiny 386-20 is a terrific and economical choice for a knowledgeable user who is interested in customization and brand-name parts. Its documentation, however, needs improvement.

CIRCLE 425 ON READER SERVICE CARD

THE SYSTEM BOARD

At the heart of the Destiny 386-20 is the Corrado motherboard, which uses the Chips and Technology VLSI chip set and AMI's BIOS, making it comparable to the more reputable albeit more expensive 386 machines on the market. The Corrado sports two 8-bit slots, five 16-bit slots, and one 32-bit proprietary slot for a maximum 16MB RAM expansion card. There are no ports on the motherboard, so you should take care to note that you will need to use some of your free slots for the incorporation of ports. The motherboard itself contains 2MB of SIPs using 80-nanosecond 256-kilobit DRAM chips. 64K is dedicated to shadow RAM. You can, however, expand memory on the motherboard to a maximum of 8MB.

To keep the price of the Destiny 386-20 low, RAM caching is not available. For the same reason, sockets are reserved for both the Intel 80287 and 80387, but the coprocessors are not included in the list price and must be purchased separately. Currently the Corrado motherboard in the 20-MHz model is not capable of accommodating the Weitek modules, although its speedier sibling, the Destiny 386-25, does.

Another feature of the Destiny 386-20, which can be positive or negative depending on your level of computer expertise, is that setup is provided on the motherboard. You have the ability to flip between 0 and 1 wait states, select page-mode or interleaved memory (as long as your motherboard contains the required 2MB of RAM to run true interleaved memory—otherwise the default is page-mode), and generally have complete control over the tailoring of your system through the use of this Extended Memory Setup program.

But beware: even the most advanced users risk changing something accidentally that can cause your system to crash. If you are a novice, you will run into problems with this program because the only piece of documentation included with the Destiny 386-20 is a generic manual that is far too technical and not nearly clear enough for a first-time user. Usually manuals will include an index, glossary, or introductory section; unfortunately this one has none of the above. If you have questions regarding the setup of your computer or the extraordinarily confusing setup program, you will need to contact Destiny directly for technical support.

TEST SCORES

The Destiny 386-20 faired well enough in comparison to the other low-priced machines reviewed in this article. Its scores were right in the middle for the processor and memory segments of the PC Labs benchmark tests and generally above average in the hard disk and video segments of our benchmark tests.

Destiny Computers stakes its claim in the 386 market by meeting just about every configuration request and using name-brand, quality parts to do so.

If you are in the market for a fast, affordable, no-frills 386 machine, have a cooperative dealer, and know exactly what configuration you need, the Destiny is an intelligent choice. You can be confident about receiving a machine sporting fine workmanship and brand-name components. Although Destiny is terrific for offering tons of options, it is evident from the documentation that the company assumes that everyone purchasing a 386 is knowledgeable in the field. If you are, you'll be fine; if not, be prepared to spend some time on the phone.

IF YOU'RE LOOKING TO BUY A GREAT COMPUTER, READ THE FINE PRINT FIRST.

EDITOR'S PICK

☆ ☆ ☆ ☆

TOP CHOICE

"...among brand-name systems, the HeadStart III is an uncommonly good buy."

HOME OFFICE COMPUTING, AUGUST, 1989

"I'd definitely recommend this machine to anyone who's considering an AT-class compatible."

COMPUTE'S PC MAGAZINE, SEPTEMBER, 1989

"The amount of software included with the HeadStart III is amazing . . . a system with software and hardware extras that far outweigh its price tag."

INFOWORLD AUGUST, 1989

"The HeadStart III is about as close to a no-hassle PC as I've seen."

LOS ANGELES TIMES, NOVEMBER 24, 1988

"If it sounds like we're raving about this machine we are."

COMPUTER BUYERS GUIDE, 1989

PC WORLD BEST BUY

"...It's hard to imagine a better choice."

PC WORLD, JUNE, 1989

"Using a HeadStart III is almost as easy as plugging it in."

COMPUTER WORLD MAGAZINE, MAY, 1989

SPECIFICATIONS

MICROPROCESSOR: Intel 80286-12
SPEED: 12MHz/8 Switchable
BIOS: Award
BUILT IN RAM: 1 Megabyte
EXPANDABLE TO: 3 megabytes
POWER SUPPLY: 145 watts 110/220 switchable
KEYBOARD: 101 key PS/2 compatible
GRAPHICS: VGA Autosync
FLOPPY DRIVES: one 5.25" 1.2 megabyte, one 3.5" 1.44 megabyte
HARD DRIVE: 32.1 megabyte, 28 milliseconds, 1:1 interleave
BUILT IN INTERFACES: Parallel, 2-RS232 serial, mouse, joystick
EXPANSION SLOTS: 3 available
MOUSE: Standard
SOFTWARE: DOS 3.3, GW Basic, HeadStart Advanced Environment, Floppy Driver, Framework II, 3-D Graphics, ATI and Computer★Ease Tutorial Software, XTree hard disk manager, Publish-it! Chessmaster 2000, Splash, VGA paint program, Bookmark, plus Twist and Shout.

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CIRCLE 391 ON READER SERVICE CARD

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EVEREST COMPUTER CORP.

Everest Block 320V

by Bruce Brown

Everest may be just another mountain to you, but Everest Computer Corp. is the computer sales side of CMP Enterprise Co., a company that designs and manufactures system boards. And at $2,990, the Everest Block 320V just barely makes our list of the 12 cheapest computers in the 20-MHz 386 class.

The Block 320V comes in an attractive, small-footprint case that measures 6.5 by 16 by 16.5 inches (HWD). The FCC Class A system includes 2MB of RAM, a Conner 42MB hard disk, a 1.2MB floppy disk drive, an ATI 16-bit VGA Wonder board, and a Seiko CM-1430 color VGA monitor. Standard ports include two serial, one parallel, and one game. The Nan Tan Computer Co. keyboard features 101 keys, with top-row function keys and an 80-inch cable. DOS 4.01 costs $100 extra.

It may be hard to think of a motherboard as being attractive, but the CMP motherboard in the Everest machince is a sharp-looking component, with slots, memory-chip sockets, ROM chips, and 386 chip set laid out neater than a Midwest suburb. The Block 320V uses AMI ROM BIOS chips and a full Chips and Technologies 386 chip set. There are sockets for both 80287 and 80387 math coprocessors.

The Everest Block 320V ($2,990) hosts a sharp-looking motherboard inside its small-footprint case; slots, memory-chip sockets, ROM chips, and the 386 chip set are laid out with admirable care. In addition, the 42MB Conner drive and proprietary IDE high-speed controller combine to yield top performance.

RESPECTABLE TEST SCORES

With a 20-MHz 386 processor, 80-nanosecond memory, and no RAM cache, the Block 320V achieved respectable scores on the PC Labs processor and memory benchmark tests. Standard memory consists of 2MB of 100-ns. RAM made up of 256-kilobit SIP modules. The test machine came with 80-ns. chips, which Everest said it supplies when it has them. The benchmark test scores shouldn't vary much—if at all—with 100-ns. rather than 80-ns. chips, but be aware that Everest's scores were taken on a machine with 80-ns. chips.

Maximum motherboard memory is 8MB. The two 32-bit slots can each hold 32-bit memory boards, but the maximum system memory is 16MB. Without processor RAM cache, the Everest uses page-mode memory to attain virtual zero-wait-state operation. Both ROM and video BIOS can be shadowed in RAM, but whether shadowing is on or off, the top 384K of memory is unavailable for other uses.

The Everest case can hold three half-height drives, each of which can have an exposed front for removable storage media. There's also room for one 3.5-inch drive mounted on its side without an exposed front. The test machine had a 42MB Conner hard disk with its proprietary IDE high-speed controller; this was one of the top-performing disk drives. The 200-watt power supply has four power leads—just the right amount for the drive bays.

While there are only seven expansion slots, two can be used for either 8-bit ISA expansion boards or proprietary 32-bit RAM cards. The remaining five slots are for standard 16-bit interface boards. The expansion bus runs at either 8 or 10 MHz. In addition to the expansion slots, there are three knockouts—two 25-pin and one 9-pin—for extra ports. In our unit, there were two 16-bit slots free, as well as the two dual-identity (8-bit or 32-bit) slots.

There is documentation for the motherboard, VGA, and I/O interface cards, but no comprehensive user, operations, or reference manual. With standard parts, experienced users won't need great documentation, but beginning users should be aware that there's little help provided here.

MOSTLY DEALER SALES

Everest sells most of its computer systems through dealers and sales representatives. While it is not in the mail-order business, it will sell to users who contact the company directly. All Everest systems include a one-year depot-service parts-and-labor warranty (you must drop off the PC at a repair center). Most service is handled by dealers, but if shipment to Everest is necessary during the warranty period, the company pays to send the machine back.

Other than its well-designed motherboard, there's nothing very special about the Everest Block 320V—but that's not bad, especially when you consider the price. This is a competent machine with ample room for expansion, and its performance numbers fall within the expected range for the 20-MHz 386 class without a RAM cache.

Compared with competing units from lesser-known companies, the Everest is perhaps a bit pricey, but since it's sold by dealers, you may be able to get a discount or enough support to make the extra money worth spending.

FACT FILE

Everest Block 320V
Everest Computer Corp., 1153 Tasman Dr., Sunnyvale, CA 94089; (408) 734-2604.
List Price: With 2MB RAM, 40MB hard disk, 1.2MB 5.25-inch floppy disk drive, VGA monitor, diagnostics, $2,990. DOS 4.01, $100.
In Short: One of the most expensive of the cheapest 386/20s, the Everest Block 320V combines name-brand parts in a safe-bet, noncached, moderate performer.

CIRCLE 426 ON READER SERVICE CARD

LASER DIGITAL INC.

Laser Digital Pacer 386-20

by Alfred Poor

At $2,995, the Laser Digital Pacer 386-20 has the questionable distinction of being the most expensive machine in this survey of cheapest computers, having nosed out the Everest offering by just five dollars. The machine's case sports a sculpted plastic front that looks strikingly different from other clones. But what else do you get for a few hundred dollars more than the competition?

One big difference lies at the heart of the machine. While many other clones rely

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on motherboards designed and built by Mylex, Micronics, and other suppliers, the Pacer 386-20 uses a Laser Digital motherboard. The board looks much like other designs: a pair of 32-bit slots, five 16-bit slots, and an 8-bit slot running at 6.67 or 10 MHz, plus room for DIP-style memory chips.

In other respects, however, the motherboard is a bit different—starting with the unusual memory configuration. Instead of using banks of just 1-megabit or 256-kilobit chips, it uses both. There are two banks of eight 1Mb chips and an extra bank of eight 256Kb chips for parity; the three banks yield 2MB of total memory. The motherboard has room for 4MB in all, and you can bring the system up to a total of 16MB with 32-bit expansion cards.

FAMILIAR COMPONENTS

The system had some components that appeared in other packages reviewed here. The 40MB hard disk, for example, is a Seagate ST-251-1, the 1.2MB floppy disk drive is from TEAC, and the color VGA monitor was a Tatung CM-1460.

Other components were less familiar. The 16-bit combination floppy/hard disk controller came from AMS, and the VGA card came from NSI. The adapter supports 800 by 600 resolution and comes with drivers for many different programs. You'll need a multiscanning monitor to take advantage of this feature, however. In addition, the adapter is only an 8-bit card, which explains its poor showing on PC Labs' video benchmark tests. The processor, memory, and hard disk performance was in the middle of the dozen units reviewed.

The $2,995 Laser Digital Pacer 386-20 is built around the company's own motherboard, which sports an unusual memory configuration: you get two banks of eight 1-megabit chips and an extra bank of eight 256-kilobit chips for parity; the three banks yield 2MB of total memory.

FACT FILE

Laser Digital Pacer 386-20
Laser Digital Inc., 1257B Pasman Dr., Sunnyvale, CA 94089; (800) 826-4225, (408) 747-1966.
List Price: With 2MB RAM, 40MB hard disk, 1.2MB 5.25-inch floppy disk drive, VGA monitor, DOS 3.3, utilities, $2,995.
In Short: The Pacer 386-20 has a pretty face but the highest list price of the pack, and its slow performance, misleading documentation, and potential pitfalls for novice users make it even less attractive.

CIRCLE 427 ON READER SERVICE CARD

LASER DIGITAL PITFALLS

The Pacer 386-20 has more-serious problems than video speed. The system documentation, for one, arrives in a handsome binder. You may be surprised by the weight; it has much more inside than most competitors. But the surprise will turn to disappointment when you examine the contents. About two-thirds is DOS documentation supplied by Microsoft.

There is an attractive manual prepared by Laser Digital specifically for the Pacer 386-20. While it is a big improvement over the motherboard manuals provided by most of the other clones, it still falls far short of the mark. The section on motherboard configuration is well illustrated but refers to a different board from the one supplied in this system. The system comes with the Chips and Technologies advanced setup utility on-disk but without any documentation. This is a handy utility that gives knowledgeable users the chance to fine-tune performance, but in the hands of a novice, it can quickly reduce the entire computer to a lifeless mass that can't boot at all.

Users will find other pitfalls. Among them are some I/O ports neatly labeled RS-232-1 and RS-232-2 on the back of the case, plus an unlabeled parallel port. Not until you take off the cover do you discover that ribbon cables from these connectors go nowhere—which is exactly where your data will go if you get suckered into hooking up to one of these. Instead, you need to plug into the unlabeled ports on the separate I/O card. According to a Laser Digital representative, the extra ports allow you to hook up a 9-pin serial port instead of the 25-pin port that comes with the card.

One more gotcha: you can change the processor speed from the keyboard (a feature clearly documented in the manual), but the machine gives no indication that a change has taken place—no beep, no turbo light on the front panel, no change in cursor shape. An inadvertent combination keystroke could leave your processor hobbled without your knowledge.

The Pacer 386-20 is sold through dealers and comes with a typical one-year warranty. To get warranty repairs, you must ship the system back to California at your expense. (Laser Digital will pay the return shipping.) In these days of express parts replacement and on-site warranty service, this is about the minimum acceptable policy currently available.

So for the extra money that the Laser Digital Pacer 386-20 costs you, you get a slower display, misleading documentation, mislabeled ports, and some other handy features that can cause you trouble and grief. This unit may make it into the cheapest dozen, but it can't compete with the values offered by some others that are lower on the price list.

NORTHGATE COMPUTER SYSTEMS INC.

Northgate MicroStation 386/20

by Bruce Brown

When is smaller better? How about when it's all you really need? Northgate Computer Systems has traditionally sold systems only in large-size cases, but recently it's come out with a MicroStation line for single-user or workstation computers that still provides ample power and storage and reasonable expansion room. The Northgate MicroStation 386/20 doesn't take up a lot of room, at only 4.25 by 16.5 by 16 inches (HWD), but it delivers plenty of computer for a price you might expect to pay for a 286 system.

At $2,549, the MicroStation 386/20 includes 2MB of RAM, a 42MB hard disk, your choice of a 1.2MB or 1.44MB floppy disk drive, a 16-bit Video Seven VGA card, a Princeton Graphics Systems color VGA monitor, two serial ports, one parallel port, and Northgate's own excellent

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- Intel 80386-33 CPU with 4MB of RAM expandable to 16MB of 32-bit memory.
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- 1.2 or 1.44MB floppy drive.
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- EMS 4.0 software drivers included.
- Expansion slots: 5 16-bit and 2 8-bit slots.
- 230W power supply
- 16-bit VGA adapter w/512K, 1024 x 768 resolution.
- NEC Multisync 3D monitor.
- Options include hard disks from 20MB to 300MB, tape backup, modem, mouse, WordPerfect dey caps, DOS, extra floppy, monitors, game card, coprocessor, and tower case.
- **$4314**
- Prices start at $3145 for mono system w 1MB. (Under PC logo 386-20 May 30)

SX Power at a 286 Price

80386SX-16 Intel

- 80386SX 16MHZ cpu (Norton SI ver 4.0: 18).
- 1MB RAM standard, expandable to 8MB on motherboard.
- 80387SX coprocessor socket
- EMS 4.0 software drivers.
- Expansion slots: 4 16-bit and 2 8-bit slots.
- 1.2 or 1.44MB diskette drive.
- 200W power supply.

CPU Card

- Open architecture design allows the user to upgrade the system from a 386SX-16 to a 386-20, merely by purchasing a new CPU card. This lets you keep all of your options open for the future.
- 16-bit VGA adapter w/512K, 1024 x 768 resolution.
- NEC Multisync 3D monitor.
- Additional options listed under 80386-25 system.
- **$2224** Prices start at $1355 for full mono system.

PC MAGAZINE — EDITOR'S CHOICE — Data World 386-20 — May 30 1989

"Dataworld's Data 386-20 and Data 386-25 stand out in the 20 and 25 MHz catagories for speed and quality construction." (May 30, 1989)

PC MAGAZINE — EDITOR'S CHOICE — Data World Data 386-25 — May 30 1989

"The Dataworld Data 386-20 minitower and Data 386 full-size tower are good values and first-rate performers from an up-and-coming mail order firm..."

PC MAGAZINE — EDITOR'S CHOICE — Data World Data 386-16 — February 28 1989

"The Dataworld offers a 16-bit video system with a top-quality NEC MultisyncII monitor and an exceptionally fast disk-drive controller for an impressive combination of value and performance...from a vendor with an increasing reputation for quality." 16 MHz system. (Feb. 28, 1989)

PC MAGAZINE — EDITOR'S CHOICE — Data World Portacomp II — October 11 1988

"The Portacomp II is a value leader with fast memory, a fast drive controller and a terrific keyboard...Marvelously cheap powerful alternative...outperformed the other 286's. (Oct. 11, 1988)

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M.I.P.S. Magazine; October 1989

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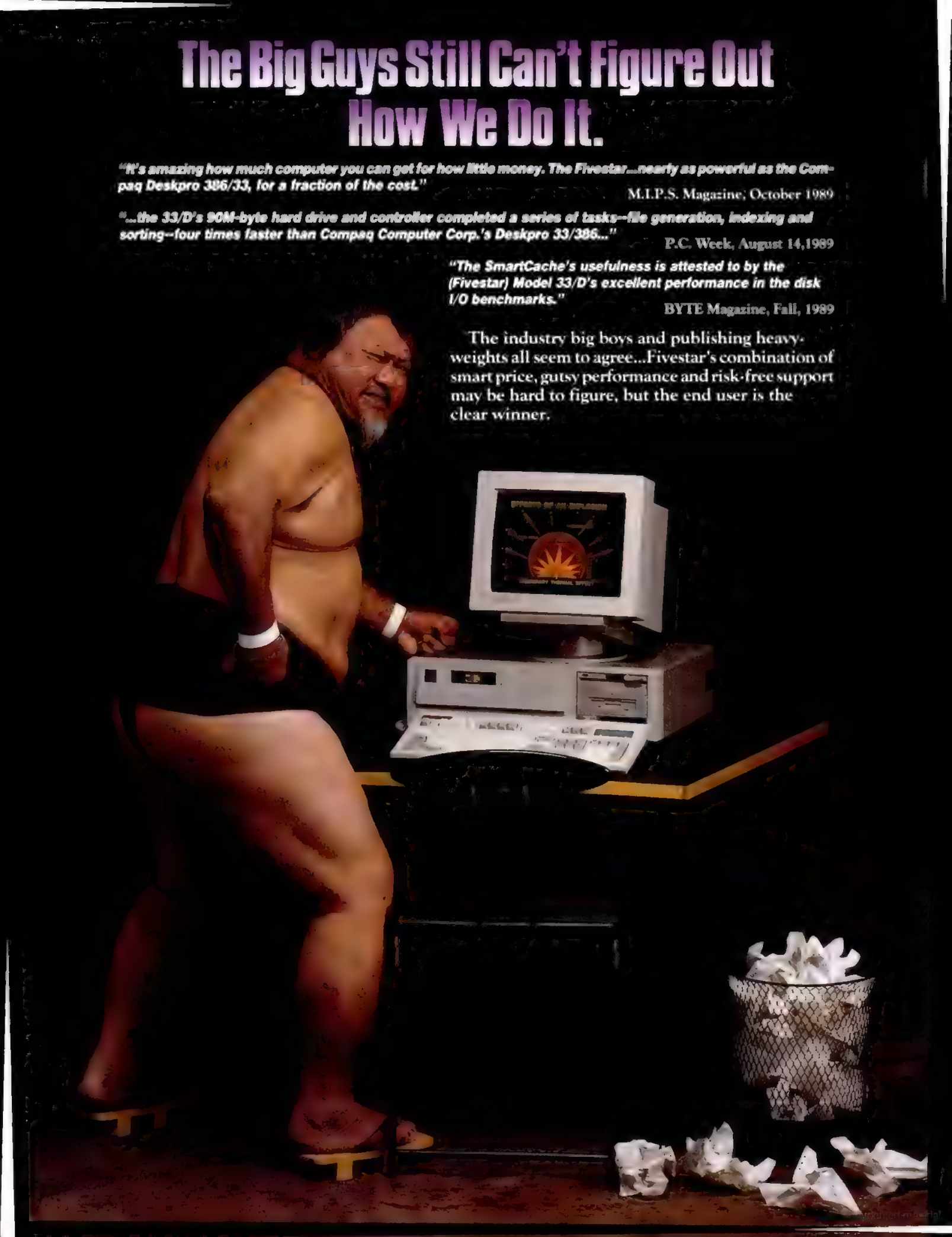
P.C. Week, August 14,1989

"The SmartCache's usefulness is attested to by the (Fivestar) Model 33/D's excellent performance in the disk I/O benchmarks."

BYTE Magazine, Fall, 1989

The industry big boys and publishing heavyweights all seem to agree...Fivestar's combination of smart price, gutsy performance and risk-free support may be hard to figure, but the end user is the clear winner.



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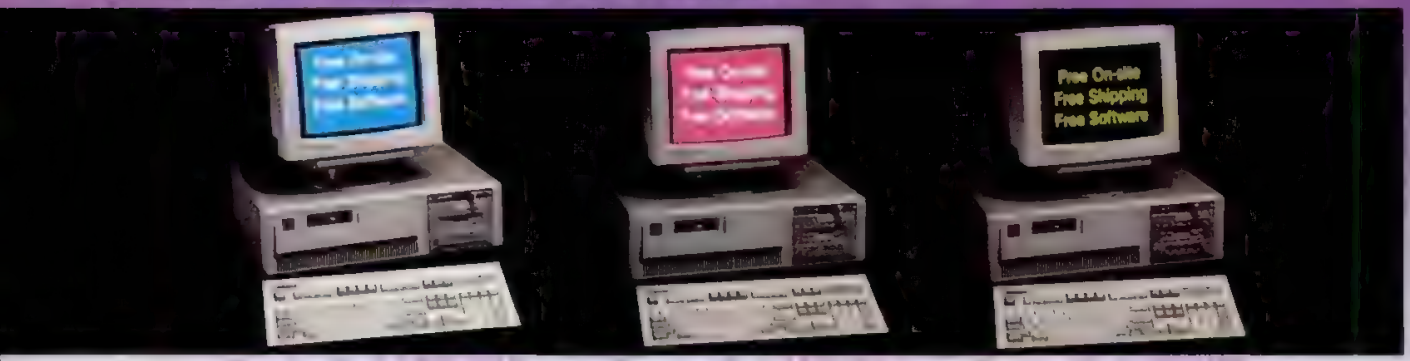

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CIRCLE 319 ON READER SERVICE CARD

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OmniKey Plus keyboard with an 80-inch cable. Standard software includes DOS 3.3 or 4.01, GW-BASIC, and an on-line system and MS-DOS reference program. FCC Class B rating was pending at the time we reviewed the system.

The MicroStation 386/20's processor can be slowed to 10 MHz if necessary, but most likely you'll keep it at 20 MHz. With all settings on high, the Northgate scored in the low-to-middle range on all the PC Labs benchmark tests.

The MicroStation 386/20 uses AMI BIOS chips and Northgate's own motherboard. The tested unit had integral parallel and serial ports, an integral floppy disk drive controller, and a tree expansion bus design, but it also had a video card in a 16-bit slot. Newer units will have the VGA circuitry built in as well.

PIPELINE MEMORY

Motherboard memory can be expanded to 8MB, the system maximum for 32-bit memory. The Northgate uses either 256-kilobit or 1-megabit chips in SIMM packaging. The MicroStation 386/20 doesn't have RAM cache memory, but it uses pipeline memory addressing and page-mode memory to attain near-zero-wait-state performance.

Pipeline memory addressing uses one pin on the 386 chip to look at the memory address of the next instruction. If the next step requires finding a memory address, pipelining eliminates one memory wait state.

The system has room for two half-height and one one-third-height drive. As delivered, the system has one empty bay, the size of which depends on whether you order a 1.2MB or 1.44MB floppy disk drive. The Conner Peripherals 40MB hard disk uses Conner's Interface Design Enhancements (IDE) drive controller technology. The 150-watt power supply has four device power leads.

The Northgate MicroStation 386/20 is a $2,549 system that measures only 4.25 by 16.5 by 16 inches (HWD). While Northgate's own motherboard offers seven vertical expansion slots, an expansion tree board with its own horizontal slots takes up a normal 16-bit slot. The expansion tree lets you accommodate three full-length 16-bit cards and two half-length 8-bit cards.

The MicroStation's most obvious dimension is its height—or rather its lack of it; this restricts the drive bays to no more than two high. The other design factor that keeps the box short is the arrangement of the expansion slots. The motherboard actually comes with seven vertical slots, since it is also used in larger systems, but a short expansion-tree board with its own horizontal slots sits in one of the normal 16-bit slots. Using the tree, you can fit three 16-bit full-length cards and two 8-bit half-length expansion cards. The expansion bus runs at the industry-standard 8 MHz.

The short case has flush-mounted power, reset, and turbo buttons on its front. The usual lights monitoring power, hard disk access, and turbo mode are on the front as well. There is no system keylock.

NORTHGATE FRILLS

Like all Northgate systems, the MicroStation comes with a comprehensive user guide and a laminated quick-reference card. You'll get the quickest assistance by using the standard on-line Hypertext-style help and reference program. Northgate's abundance of user documentation is admirable and unique in this roundup.

Northgate's one-year parts-and-labor warranty is augmented by its toll-free technical-assistance number and its on-site service. If you have a problem with a Northgate computer, call the 24-hour help line to locate the source of the problem. Northgate will ship replacement parts overnight without billing you; you can send the defective part in after receiving the good one. If you need help installing replacement components, the on-site service vendors will show up the next day to do the installation.

Northgate's MicroStation 386/20 is a good reason for not buying a 386SX system. With the Northgate machine, you get a solid set of components with true 20-MHz 386 performance, sufficient expansion for most single users, complete software, documentation, and technical support for less than many companies charge for similarly configured 386SX systems. When it's this good, this cheap, why buy less?

PC FACT FILE

Northgate MicroStation 386/20
Northgate Computer Systems Inc., 13705 First Ave. N., Plymouth, MN 55441; (800) 548-1993, (612) 476-4400.
List Price: With 2MB RAM, 42MB hard disk, 1.2MB 5.25-inch or 1.44MB 3.5-inch floppy disk drive, VGA monitor, DOS 3.3 or 4.01, GW-BASIC, utilities, $2,549.
In Short: Through on-board integration of major component interfaces, the compact Northgate still has four free expansion slots. A moderate performer, the MicroStation 386/20 has a competitive price, full software including DOS, an on-line hypertext system reference, and commendable support.

CIRCLE 429 ON READER SERVICE CARD

POLYWELL COMPUTERS INC.

Polysystem MI-Cache-20

by Winn L. Rosch

Many attractive features mark the Polysystem MI-Cache-20 from Polywell Computers as a $2,650 machine of distinction. But just as many little details detract from its quality feel.

The colorful plastic logo in the corner of its ordinary AT-style case shows that the Polysystem has more corporate support behind it than a mere garage shop. Polywell has been crafting American-made computers for three years, not just for the direct market (where the Polysystem is aimed), but also for sale under the private labels of other vendors.

But the same front panel shows a dismal lack of attention to detail. The big turbo push button does nothing, while the adjacent reset switch works fine. The button is not defective but superfluous by design—the subcontracted case just comes that way, according to Polywell.

USES DISCRETE LOGIC

So goes the rest of the Polysystem. On the positive side, its Mylex motherboard does

Price
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"I am really glad I chose Gateway 2000"—Jerry Langland.

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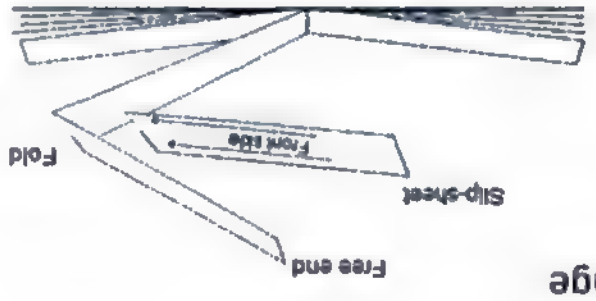

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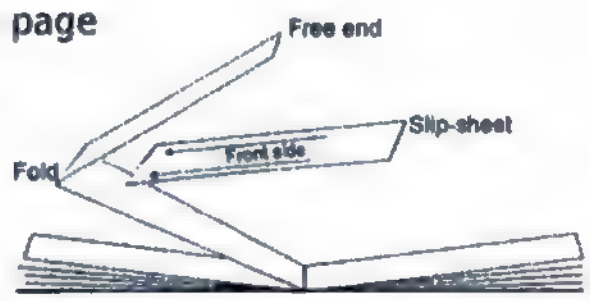

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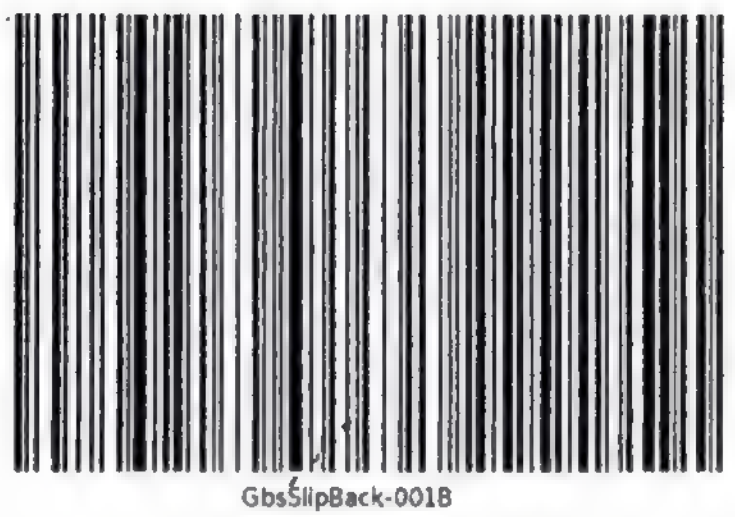

Back

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the job quickly, thanks to a proprietary Mylex discrete-logic, 64K cache of 25-nanosecond static memory. Its performance was second-fastest among the 12 reviewed machines, owing to the added benefit of the memory cache. But on the negative side, the eight SIMMs on the system board are located at the front end of its expansion slots. Although spaced to avoid touching circuit boards, expansion cards with component-laden skirts may not fit.

The eight SIMM sockets will accommodate either 256-kilobit, 1-megabit, or 4-megabit modules. Fill it with 4Mb chips and the Polysystem will attain its full 32MB maximum memory capacity, twice that of the other computers in this roundup. Alternatively, a single 32-bit expansion slot provides another opportunity for

Polywell Computers' Polysystem MI-Cache-20 ($2,650) uses a Mylex motherboard—a speedy number whose propretary, discrete-logic, 64K cache of 25-nanosecond static RAM made this the second-fastest machine reviewed. The motherboard can also fit up to a maximum 32MB of system RAM—if you can get 4-megabit chips.

memory expansion. Because of the 64K processor RAM cache, slower 100-ns. 256-Kb DRAM chips are used.

You can slow the Polysystem from its high-performance, 20-MHz speed down to an ultracompatible and ultralaggardly 8 MHz at a touch of the keyboard. For better performance, a little ingenuity will fit an 80387 coprocessor in a waiting socket. The expansion slots always operate at a standard 8 MHz.

Only one VLSI chip decorates the system board, a custom chip made by Chips and Technologies for Mylex. The Polysystem's American Megatrends BIOS includes both setup and diagnostics in its firmware code, accessible at the press of a key when you boot the system. RAM shadowing of the video and ROM BIOS is not supported.

FACT FILE

Polysystem MI-Cache-20
Polywell Computers Inc., 61C Airport Blvd., South San Francisco, CA 94080; (800) 999-1CPU, (415) 583-7222.
List Price: With 2MB RAM, 40MB hard disk, 1.2MB 5.25-inch floppy disk drive, VGA monitor, $2,650. DOS 3.3 or 4.01, $65.
In Short: A 20-MHz 80386 computer that looks good but needs more attention to detail. Strengths include a 64K memory cache and an exceptional warranty structure.

CIRCLE 542 ON READER SERVICE CARD

Of the six 16-bit and one 8-bit expansion slots (in addition to the 32-bit memory slot, which also supports an 8-bit card), three are filled at the factory. One contains a 16-bit ProDesigner VGA video adapter from Orchid Technology. Another holds a generic I/O card bedecked with one serial, one parallel, and a game port. Unfortunately, this board did not fit properly into its socket—the thin rear panel of the Polysystem chassis had to be bent backward to slide the board completely into its expansion connector.

NO-NAME DISK CONTROLLER

Details really fail the Polysystem when it comes to the drive controller. Instead of the Western Digital WD100V-MM2 1:1 interleave controller, the evaluation system was equipped with a Taiwan-made clone (labeled only "Flytek" on its ROM), which the Polywell describes as an equivalent, since it uses three Western Digital chips.

Polywell sells the Western Digital controller and sent us one to prove it. Be sure to specify your preference if you have one. Otherwise, the disk drive hardware in the test system mirrored most of the other systems: a TEAC 1.2MB floppy disk drive and a Seagate ST-251-1 40MB hard disk. Both of the unit's scores on the DOS File Access benchmark test rated in the top quarter of the units reviewed.

The 220-watt Kingspao power supply offers four drive connectors, leaving two available for future expansion. The expected five AT-style half-height drive bays (the right three with front-panel access for removable media such as a tape backup device) all use ordinary AT-style plastic mounting rails. Remember, you will need to split a power line if you install a fifth device.

Polywell offers a choice of color fixed-frequency VGA displays, either a Relisys RE9513 or a Quimax 3114. The company recommends the latter but sent the former for review. It produced an acceptable image on its 13-inch (diagonal) screen. A tilt/swivel base is standard.

Polywell provides a two-year warranty on the Polysystem's motherboard, monitor, and display adapter and an unusual one-year parts, five-year labor warranty on the overall system.

If you like what you see on the outside and don't peer too critically inside, you'll be happy with the appearance and performance of the Polysystem MI-Cache-20, particularly with the boost provided by its memory cache and the extended warranty. Polywell, however, could be a *real* market contender if it added some polish to its rough edges.

TANGENT COMPUTER INC.
Tangent 320
by Susan L. Hayes

The Tangent 320, from Tangent Computer, is a desktop machine that looks and acts like most of its inexpensive counterparts in

The $2,395 Tangent 320 conveniently places its lock, reset, and turbo switches at the front of the machine; these are joined by LED indicators for the floppy and hard disk drives, as well as power-on and turbo modes. Also accessible from the front are the machine's five half-height bays.

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CIRCLE 294 ON READER SERVICE CARD

this roundup. But with a price tag of $2,395—including 2MB RAM, a 40MB hard disk, a 1.2MB floppy disk drive, and VGA—Tangent jointly holds the title of the least expensive unit reviewed. And if support and service rank high on your list of priorities, your search for an affordable 20-MHz system could end here.

Tangent's commitment to customers begins with the documentation that accompanies the system. Hardly skimpy, a three-ring binder bulges with plenty of information about this FCC Class A–rated PC. The documentation includes directions for installing additional memory and a math coprocessor, as well as an in-depth troubleshooting guide and glossary that are clearly written for beginners and experts.

Tangent also includes manuals from its brand-name parts manufacturers, among them Video Seven, SIIG, and MiniScribe. If that doesn't do, Tangent offers a toll-free support hotline. A one-year parts-and-labor warranty plus a 30-day money-back guarantee further help to ease anxieties.

OUR TESTED UNIT

A sleek Relisys VGA color monitor and a Tangent Enhanced-style keyboard with a firm, clicky touch accompanied our tested unit. The Tangent 320's standard desktop case does take up some space, but it also offers you enough room to move around the easily accessible and well-laid-out interior. The lock, reset, and turbo switches are conveniently located on the front left of the system unit, and LED indicators are present for power-on, turbo, and floppy and hard disk drives. Five half-height drive bays are accessible from the front of the computer, and several cases are available from Tangent upon request.

Two 8-bit, four 16-bit, and one 32-bit proprietary slot (which can also be used as an 8-bit slot) reside on the Data Expert motherboard. Five expansion slots remained free after our tested unit filled one slot with an I/O card offering one parallel, two serial, and one game port and another with an MFM proprietary floppy/hard disk controller; this controller handles the MiniScribe 40MB hard disk and can manage up to two floppy disk drives. Tangent doesn't limit your hard disk options, offering a variety of sizes and controllers, including SCSI and ESDI interface choices, in addition to ST-506.

A 285-watt power supply keeps things going, and a standard Chips and Technologies VLSI chip set and an AMI BIOS rest on the motherboard. An 80387 math coprocessor socket is present as well, but it lies halfway under the hard disk. The Tangent can run at 16 or 20 MHz, and the bus speed can be set at 6, the more common 8, or a speedy 10 MHz.

The system supports up to 16MB of RAM; 8MB are placed on the motherboard, and an additional 8MB can be added using a 32-bit expansion card. The

EDITOR'S CHOICE

Tangent 320
Tangent Computer Inc., 303 Beach Rd., Burlingame, CA 94010; (800) 223-6677, (415) 342-9388.
List Price: With 2MB RAM, 40MB hard disk, 1.2MB 5.25-inch floppy disk drive, VGA monitor, $2,395. DOS 3.3 or 4.01, $88.
In Short: The Tangent 320's price earns it the distinction of being tied with the ACMA as the cheapest 386/20 on the market. With quality parts backed by excellent support and service, Tangent may offer the most for the least.

CIRCLE 543 ON READER SERVICE CARD

It takes a great performance for a disk to become a legend. Chuck Berry has what it takes. And so does PROCOMM PLUS. It gives you power and ease of use that surpasses communications software costing $250 or more. Yet PROCOMM PLUS costs much, much less. Which simply means when you want communications software that gives you a great performance, you can still *be good* to your wallet.

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CIRCLE 504 ON READER SERVICE CARD

When PC Magazine searched for words to describe Acma, they chose...

Impressive! Performance! Our Favorite!

PC Magazine Review November 28, 1989

Recently, PC Magazine reviewed 386-25MHz computers and proclaimed our's as their "favorite." They praised our Cache computer for "...its performance, good expansion possibilities, 45-day money-back guarantee, and a two year warranty." They called it " impressive."

ACMA 286/12

Desktop System

- Intel 80286-12 CPU running at 6/12MHz (keyboard switchable)
- Chips & Technologies ***"NEAT" CHIPSet***, and AMI BIOS
- 512K RAM, expandable to 8MB on system board (100ns)
- 0 wait state with page mode interleaved arrangement
- 384K Shadow RAM
- Five 16-bit & three 8-bit slots
- 200W UL, CSA & TUV approved power supply (110/220V)
- Supports EMS/LIM 4.0
- Supports 80287 math coprocessor
- 1.2MB or 1.44MB floppy drive
- 1:1 interleaved dual hard/floppy disk drive controller
- Parallel, serial & game ports
- Clock calendar w/battery back-up
- Enhanced 101-key keyboard
- Choice of Mini or Standard case (Vertical case option $175)

$775

With Monitor & Video Board	Mono	EGA	VGA
40MB/28ms	$1,259	$1,559	$1,659
65MB/28ms	$1,399	$1,699	$1,799

ACMA 386/20

Professional System

- Intel 80386-20 CPU running at 6/8/16/20MHz
- AMI BIOS
- 1MB 32-bit high-speed RAM, expandable to 16MB (System board expands to 8MB of 32-bit RAM)
- 0 wait state with page mode interleaved arrangement
- Shadow RAM for system & video BIOS relocation
- Supports EMS/LIM 4.0
- Supports 80287, 80387 and Weitek math coprocessors
- One 32-bit, five 16-bit & two 8-bit expansion slots
- 200W UL, CSA & TUV approved power supply (110/220V)
- ROM-based setup
- 1.2MB or 1.44MB floppy drive
- 1:1 interleaved dual hard/floppy disk drive controller
- Parallel, serial & game ports
- Clock calendar w/battery back-up
- Enhanced 101-key keyboard
- Standard case (Vertical case option $175)

$1,495

With Monitor & Video Board	Mono	EGA	VGA
65MB/28ms	$2,099	$2399	$2,499
120MB/28ms	$2,499	$2,799	$2,899

ACMA 386/25

Business System

- Intel 80386-25 CPU running at 6/8/16/25MHz
- AMI BIOS
- 1MB 32-bit high-speed RAM, expandable to 16MB (System board expands to 8MB of 32-bit RAM)
- 0 wait state with page mode interleaved arrangement
- Shadow RAM for system & video BIOS relocation
- Supports EMS/LIM 4.0
- Supports 80287, 80387 and Weitek math coprocessors
- One 32-bit, five 16-bit & two 8-bit expansion slots
- 200W UL, CSA & TUV approved power supply (110/220V)
- ROM-based setup
- 1.2MB or 1.44MB floppy drive
- 1:1 interleaved dual hard/floppy disk drive controller
- Parallel, serial & game ports
- Clock calendar w/battery back-up
- Enhanced 101-key keyboard
- Standard case (Vertical case option $175)

$1,795

With Monitor & Video Board	Mono	EGA	VGA
65MB/28ms	$2,399	$2,699	$2,799
120MB/28ms	$2,799	$3,099	$3,199

ACMA 386/33

33Mhz Cache System

- Intel 80386-33 CPU running at 6/8/16/33MHz
- AMI System board and BIOS
- 1MB 32-bit high-speed RAM, expandable to 24MB (System board expands to 8MB of 32-bit RAM)
- 0 wait state
- 64KB Cache, 20ns SRAM-33MHz
- Shadow RAM for system & video BIOS relocation
- Supports EMS/LIM 4.0
- Supports 80387 and Weitek math coprocessors
- One 32-bit, six 16-bit & one 8-bit expansion slots
- 200W UL, CSA & TUV approved power supply (110/220V)
- Built-in setup and diagnostics
- 1.2MB or 1.44MB floppy drive
- 1:1 interleaved dual hard/floppy disk drive controller
- Parallel, serial & game ports
- Clock calendar w/battery back-up
- Enhanced 101-key keyboard
- Standard case (Vertical case option $175)

$3,595

With Monitor & Video Board	Mono	EGA	VGA
65MB/28ms	$4,199	$4,499	$4,599
120MB/28ms	$4,599	$4,899	$4,999

286/16

With Monitor & Video Board	Mono	EGA	VGA
40MB/28ms	$1,459	$1,759	$1,859
80MB/28ms	$1,699	$1,999	$2,099

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Includes FREE Surge Protector and Printer Stand

ACMA's 386SX with Intel's 80386SX-16MHz CPU - New Enhanced AT CHIPSet - 16MHz CPU - 0 wait state - page mode interleaving - 1MB RAM - 80387SX math coprocessor support - six 16-bit and two 8-bit expansion slots - 200watt UL approved power supply - 40MB/28ms hard drive - a 1.2MB or 1.44MB floppy drive - parallel and serial ports - enhanced 101-key keyboard - 16-bit VGA card and VGA monitor with tilt/swivel stand - Panasonic 1191 printer (240/48 cps) - 6' parallel printer cable - ten diskettes - computer paper. Uprgrade with various video options and/or larger hard drives.

"386SX Executive" Special $2,245

Complete 286 Business Package

Includes FREE Surge Protector and Printer Stand

ACMA's 286/12MHz - 0 wait state - page mode interleaving - shadow RAM for BIOS relocation - EMS/LIM 4.0 support - dual hard/floppy controller - 512K RAM expandable to 8MB on the system board - ROM based setup - 80287 math coprocessor support -five 16-bit and three 8-bit expansion slots - 200watt UL approved power supply - 20MB hard drive - a 1.2MB or 1.44MB floppy drive - parallel and serial ports - enhanced 101-key keyboard - monochrome monitor with tilt/swivel stand - Panasonic 1180 printer (192/38 cps) - 6' parallel printer cable - ten diskettes - computer paper. Upgrade /with EGA or VGA displays and/or larger hard drives.

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Multisync Plus	Call
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VGA (Basic 640x480)	$195
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EDITOR'S CHOICE

- **Tangent 320**

The Tangent 320, from Tangent Computer, stands out for two important reasons: customization and documentation. For only $2,395, you get more than just 2MB RAM, a 40MB hard disk, and VGA. Tangent gives you a 30-day money-back guarantee, a selection of cases and hard disks, and other options—plus knowledgeable support. Tangent also will build whatever configuration you need; such commitment to customers is rare.

In addition, the Tangent 320's documentation is well written and comprehensive, a quality that unfortunately does not hold true for most of these 12 low-cost 20-MHz 386s. The Tangent manual comes complete with a glossary of terms, a troubleshooting guide, instructions for installing a coprocessor or more memory, and specific documentation for the components, such as the video adapter and hard disk. Tangent's test scores place it within the pack of noncached 20-MHz 386s, all of which rank faster than an SX and offer full 32-bit performance as well.

Among honorable mentions, the ACMA 386/20 Professional System offers good value at an equally great price: $2,395 buys you a solidly built machine with Class B FCC certification. Performance lags, leaving the ACMA at the bottom of the pack in that respect, but the margin from the fastest to the slowest system is trivial—less than 1 second on the PC Labs 80386 Instruction Mix test. And while the documentation could use some improvement, support is excellent, with a two-year warranty on labor. Also, the machine is built with a care for detail that not all of these low-cost 386s can claim.

For those of you looking for top-of-the-line speed at a low cost, two machines stand out because of memory-cached performance. Continental Technology's Top Gun 386/20 offers premier performance and is a strong runner-up for our Editor's Choice. With 32K of processor RAM cache controlled by the Intel 82385 chip, this $2,669 80386-based PC is a good value with reasonable stock components. However, be mindful of hidden costs, such as the $55 charge for I/O ports.

Right behind is the $2,650 Polysystem MI-Cache-20, from Polywell Computers. A 64K cache on the Mylex motherboard improves performance, giving it much better speed than the ten noncached 386 PCs. The Polysystem could use more attention to detail, but what may allay your fears is its support policy: five years on labor; two years on the motherboard, monitor, and video card; and one year for all remaining parts.

motherboard has two easily accessible memory banks, each consisting of four SIPP sockets. In this machine, both banks were filled with 256-kilobit 100-nanosecond chips, and interleaving is employed to achieve an effective .5 wait state. The machine reserves 384K for shadow RAM, which the user can disable.

Also present in our tested unit were a Video Seven FastWrite VGA adapter and a Relisys monitor. These components helped Tangent 320 capture some of the highest scores on the PC Labs video benchmark tests. On the whole, the Tangent performed adequately across the board in all our benchmark tests, and the AMI BIOS performed very well on the BIOS Disk Seek test.

Most of the machines included in this roundup offer very similar features and performances. Tangent stands out because it boasts a list price that matches the cheapest competition and still offers quality parts and exceptional commitment to service and technical support. ■

Bruce Bruce is a frequent contributor to PC Magazine. *John Dickinson is executive editor, West Coast operations, of* PC Magazine. *Susan L. Hayes is an editorial assistant at* PC Magazine. *Stephanie Izarek and Matt Ross are assistant editors of* PC Magazine. *Alfred Poor and Winn L. Rosch are contributing editors of* PC Magazine.

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BJ-130

Bubble-Jet Printer

And when it comes to virtually maintenance-free performance the BJ-130 is also in a class by itself, with built-in automatic cleaning and a unique 48-nozzle print head that lasts for years. Along with high speed operation that's so quiet you can keep the unit right by your desk, convenient cut-sheet feeding plus complete software compatibility, the BJ-130 Bubble-Jet Printer is simply faster, simply quieter, simply clearer.

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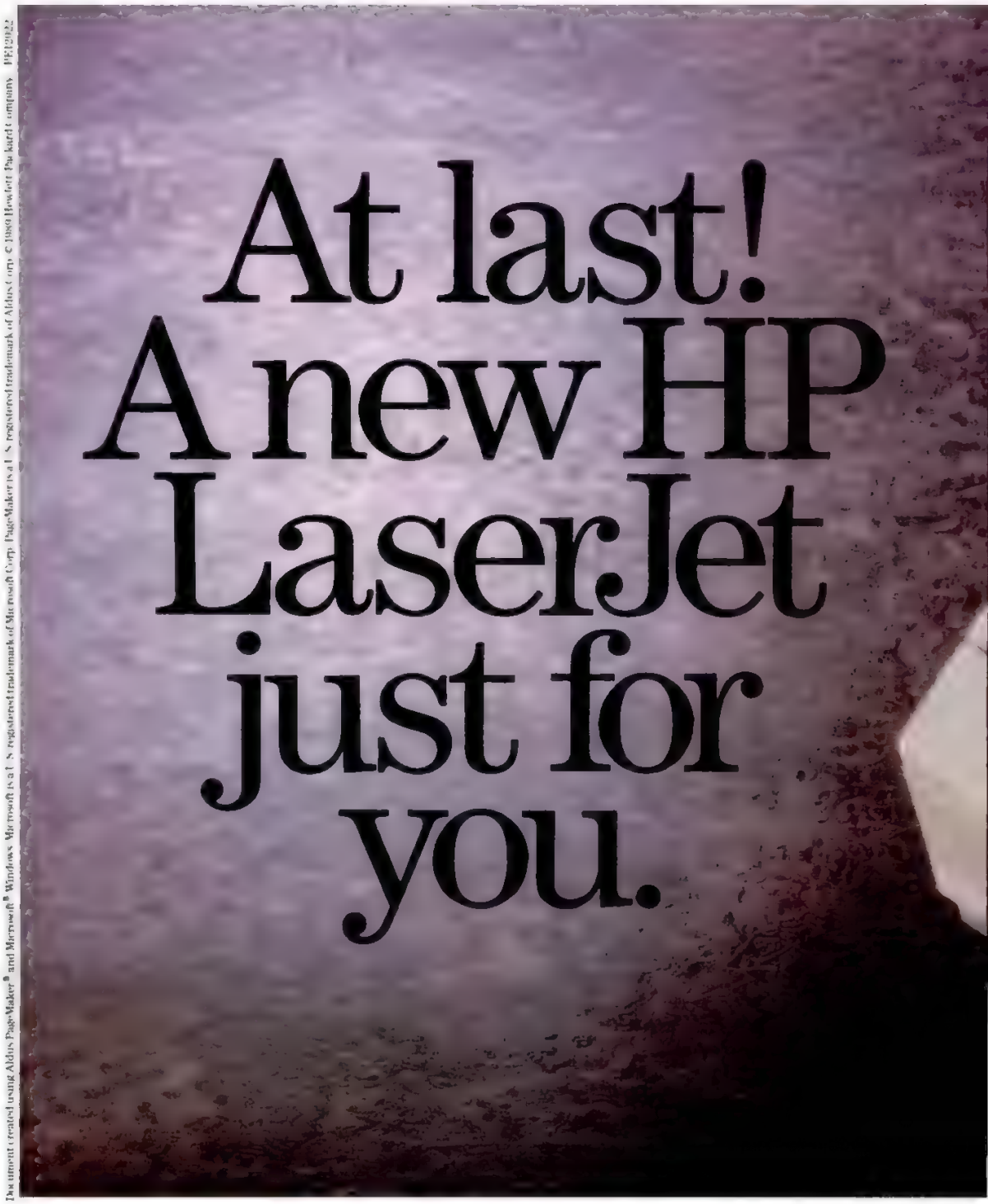

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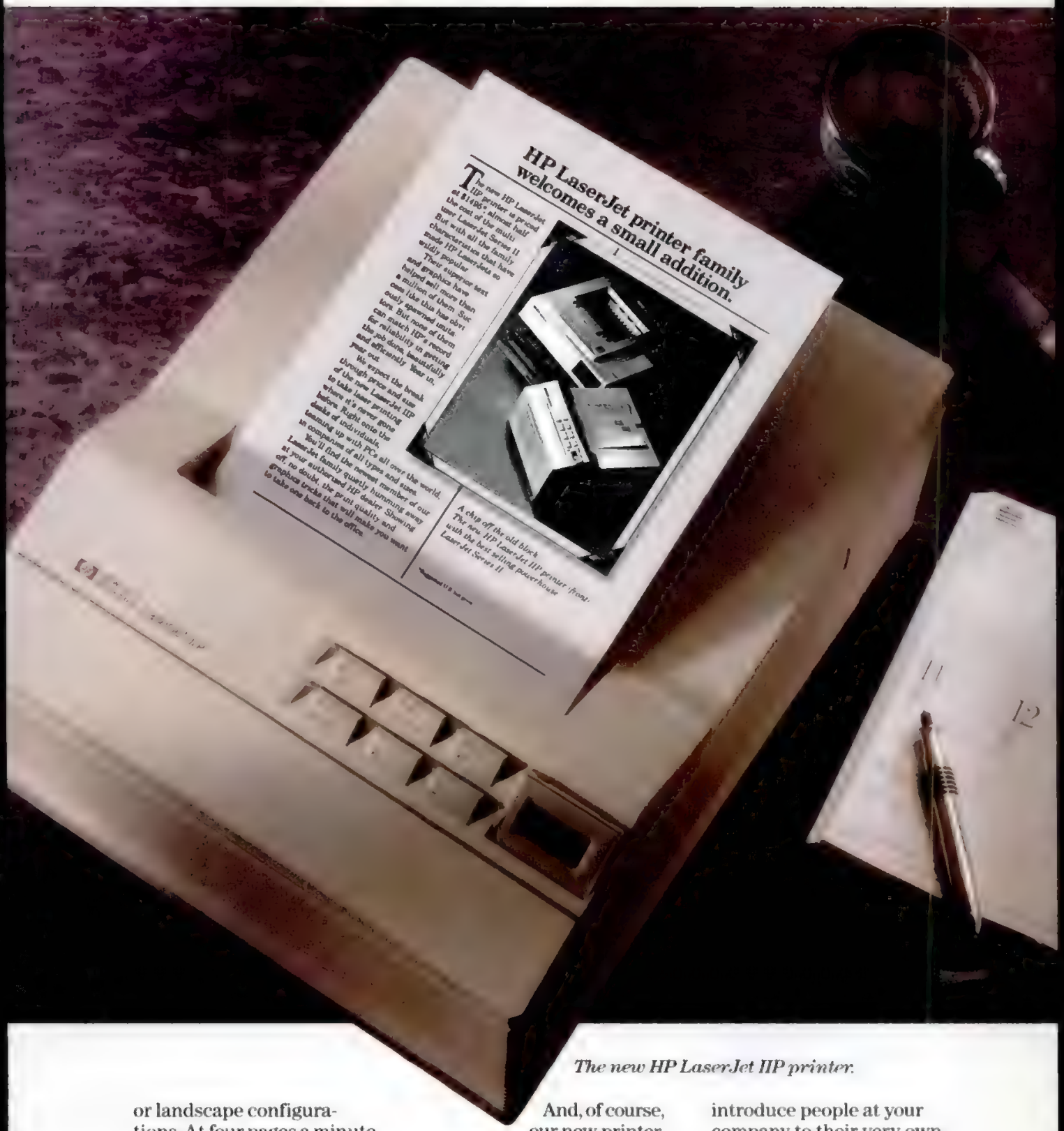
*Suggested U.S. list prices: LaserJet IIP $1495; LaserJet Series II $2695. Dealer prices vary.



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PC MAX 386DX 33 MHz

33 MHz Fast Cache (True 33 MHz CPU)

	MONO 12"	EGA 14"	VGA 14"
BASE SYSTEM	$ 3,099	$ 3,509	$ 3,709
60MB DRIVE	$ 3,699	$ 4,109	$ 4,309
120MB DRIVE	$ 4,049	$ 4,459	$ 4,659
142MB DRIVE	$ 4,349	$ 4,759	$ 4,959

Standard Features: Genuine Intel 386-25 MHz CPU • Page Interleave for Ø Wait State • 2MB RAM Memory on Board (Expandable to 8MB) • 1.2MB & 1.44MB Floppy Disk Drive • 2 Serial, 1 Parallel Port • 101 Style Enhanced Keyboard • Full-Size Desktop Case • 220W Power Supply • 1 32-bit, 5 16-bit, 2 8-bit Expansion Slots

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PC MAX 386DX 25MHz

25 MHz Fast Cache or Page Interleave (For Cache System $500.00 add'l) (True 25 MHz CPU)

	MONO 12"	EGA 14"	VGA 14"
BASE SYSTEM	$ 1,929	$ 2,309	$ 2,509
60MB DRIVE	$ 2,429	$ 2,809	$ 3,009
80MB DRIVE	$ 2,729	$ 3,109	$ 3,309
120MB DRIVE	$ 3,229	$ 3,609	$ 3,809

Standard Features: Genuine 286-16 CPU • SI=18.7 • 1 MB RAM Memory on Board (Expandable to 4MB) • 1.2MB Floppy Disk Drive • 2 Serial, 1 Parallel Port • 101 Style Enhanced Keyboard • Jr. Full-Size Desktop Case • 200W Power Supply • 6 16-bit, 2 8-bit Expansion Slots

$838 BASIC SYSTEM No Display System

PC MAX 286 16MHz

(True 16MHz CPU)

	MONO 12"	EGA 14"	VGA 14"
BASE SYSTEM	$ 928	$ 1,308	$ 1,508
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CIRCLE 103 ON READER SERVICE CARD

Integrated Software Gets It Together

ILLUSTRATION: LIBBY THIEL

The proverbial jacks-of-all-trades? These seven packages may not fully master their applications, but their growing user base of middle managers and laptop-toting professionals is saying they don't have to—that a few good ideas, realistically presented, can go a long way.

by Edward L. Perratore

It was first hailed as the PC user's dream software. From the mid-1984 introduction of integrated packages like Lotus Development's *Symphony*, Ashton-Tate's *Framework*, and the low-end *Electric Desk* from Alpha Software, the possibilities for data sharing and effortless switching among word processing, spreadsheet, and database modules seemed endless. Now *this* was computing.

After the smoke cleared, however, users began to see not a dream but a dream deferred. Despite advertisements to the contrary, not one of the integrated packages on the market was proving itself to be the one package that anyone would ever need. In fact there was plenty you *couldn't* do with integrated software packages that you did every day using standalone products.

Where was the seamless integration—the all-in-one look and

feel that made an integrated package out of a multifunction product? Where were the power-user features that were supposed to match those found in standalone packages? These uncertainties resulted in a sharp dive in expectations, which sent vendors back to the drawing board to rethink their strategies.

Things have since changed in the integrated software market. If you think current integrated packages are too shallow to deserve a good hard look, think again. True, at the high end of the market, the feature-starved power user is more likely to opt for *Lotus 1-2-3*, *WordPerfect*, or *dBASE IV* than for a high-end integrated product. But the under-$200 low-end products, the focus of this review, are adding rich features like macros and font selection to build a growing base of corporate users. In short, these products are steaming ahead of the high end and are carving niches that are all their own.

Software Publishing's $159 *PFS: First Choice* (according to the market research firm InfoCorp) sold 165,000 copies domestically in 1988—ahead of the $695 high-end market leader, *Enable* from Enable Software, by 70,000 copies. In fact, Dataquest, another market-research organization, reports that only four standalone word processors sold more copies that year.

In this feature, *PC Magazine* evaluates seven low-end packages (in the $59.85 to $199 range), including *PFS:First Choice*, Microsoft Corp.'s *Microsoft Works*, Tandy Corp.'s *DeskMate*, and Alpha Software Corp.'s *AlphaWorks*.

BREADTH, NOT DEPTH

The low-end products' market starts with a first-time PC user looking for a little bit of everything for home or small-business use—in short, looking for breadth, not depth. Spinnaker Software Corp.'s $69.95 *Better Working Eight-in-One* fulfills these needs for many; so does Tandy's $99.95 *DeskMate*. Another market is the K-12 school, where Microsoft and other vendors are doing their part to woo teachers and school administrators away from their Apple IIs and Claris's popular *Appleworks* integrated program—used by students as well as teachers.

Perhaps the fastest-growing segment, however, is corporations seeking to adopt a standard product that will suit several users with varying needs. Here, a program like *Microsoft Works* or *AlphaWorks* generally leaves behind the beginner-only realm. Corporate users generally need to share files with high-end standalone products, and the program's command structure must be identical across platforms to ensure shorter training periods.

Also within this group fall the "interrupt-driven" middle managers who find themselves switching frequently from one application to another. Graphs and tables must be embedded into documents. Mail-merging using a sorted list from the database is a common need; so is importing spreadsheet data into the database for report generation.

Above the middle managers stands the executive who has chosen to automate, has often inherited an 8088 or 80286 PC from below, and wants a program that will offer plenty without demanding too much computer expertise.

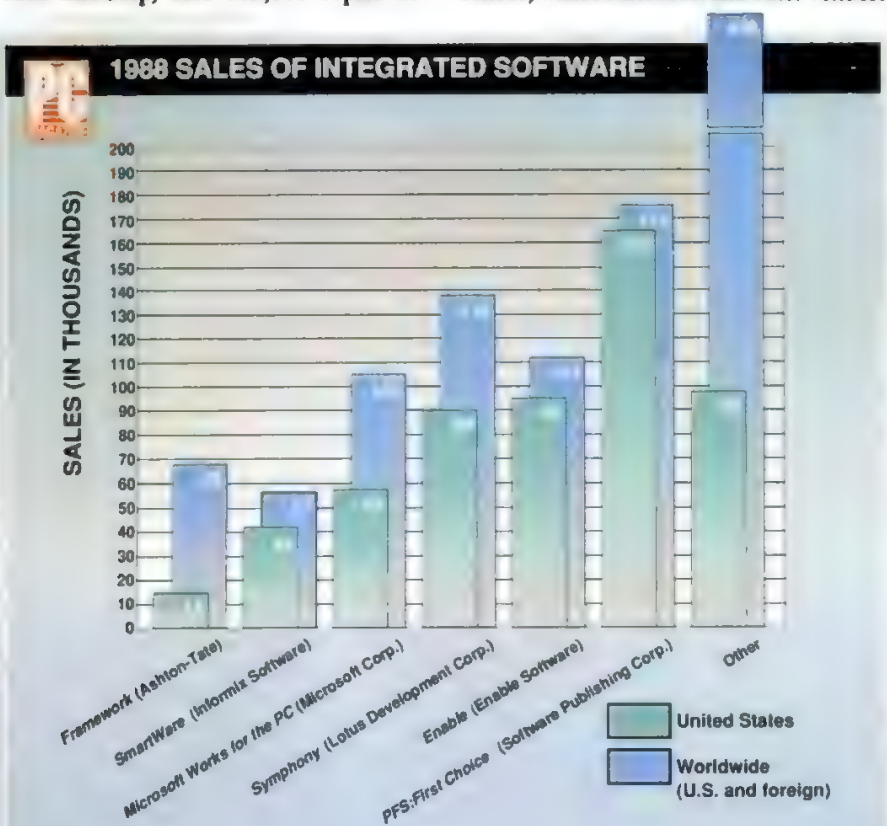
An extension of the corporate market—one that's winning back respect for integrated software—is the growing base of laptop and portable PC users. The obvious trend in the hardware is toward less bulk with equal functionality. For a salesperson in the field, why not carry every software application on one 720K 3.5-inch disk?

Several companies have already begun to recognize this audience: buy a Toshiba T1000 with a memory card, or a Mitsubishi 286-based laptop, and you'll get a bundled copy of *Microsoft Works*.

And if you're planning to consider the Poqet PC—at 1 pound, the lightest model yet scheduled to ship—and an integrated package at the same time, here's a bit of encouraging news. *AlphaWorks* will be one of about ten products to be sold on credit-card-size ROM cards available for the Poqet PC.

HOW WE CHOSE THEM

Generally speaking, even a package like Borland International's *SideKick Plus* may qualify as a form of integrated software. It offers, after all, such features as a notepad, programmable phone dialer, and time planner—sharing data through *WordStar-*



In the United States, a reported 27 percent of PC users run integrated software. The above chart shows that *PFS:First Choice* has a vast lead in domestic sales, even over high-end products like *Enable* and *Symphony*.

But in foreign markets—where integrated software has fared better over the years—the domestic market leader is outsold by all five of the other listed products.

like cut-and-paste Ctrl-key combinations.

But for most of us, *SideKick*'s benefits are considered ancillary to the more-tangible needs of integrated software buyers: a full-fledged word processor, spreadsheet, and database. For this review, the packages had to list for under $200 and include modules for at least the above three capabilities.

Communications, graphics, and *SideKick*-like desktop tools were not required for inclusion in the story—although it's a safe bet you'll want them eventually. A common user interface was a must; pressing F3 should not perform a different function in each of a program's modules. Also required was a package's ability to share data among modules, at least to some degree.

One product due for release by the time this issue ships is *Enable BP*, a scaled-down version of *Enable*. Due to offer the standard three modules plus graphics, communications, and utilities, *Enable BP* (for "business productivity") aims to provide a growth path for new users toward Enable Software's high-end product. Easy upgrades and file compatibility between the two packages are among the company's plans, as is a price structure competitive with those of *Microsoft Works* and *AlphaWorks*.

Several other packages did not meet with our criteria of price and makeup of modules. *TeleWriter* ($129) from R&S Micro Services offers a word processing and communications combination, but no database or spreadsheet. Products whose price exceeded our $200 limit included Indian Ridge Enterprises' *PC View* ($248.85 with the three required modules), Migent's $259 *Ability Plus*, Paperback Software's $249 *VP-Planner Plus*, and, of course, high-end programs like *Symphony* ($695), *Framework III* ($695), and *Smartware II* ($895).

Two popular programs met our criteria closely enough to merit inclusion in sidebars. *WordPerfect Executive*, for example, boils down *WordPerfect*, *WordPerfect Library*, and *MathPlan* into one $249 package for the executive on the road. The sum total when installed offers a word processor, spreadsheet (though no database), calendar, calculator, and phone list on one 3.5-inch disk.

The other product, *Q&A*, refuses to be pigeonholed into the integrated software niche. Having coupled an admirable flat-file database with a word processor, Symantec chose to stop there. The company reasoned that *Lotus 1-2-3* users would most likely remain *1-2-3* users, so why weigh the product down with excess baggage?

Q&A is hardly suffering from its lack of spreadsheet capability. The $349 Version 3.0 has been drawing buyer attention since its release in March 1988, and an OS/2 version began shipping in October.

TESTING INTEGRATED SOFTWARE

Although word processing is by far the most heavily used application for integrated software users—45 percent of the user's time, as opposed to 25 percent spent in the spreadsheet or database modules—*PC Magazine* designed a test suite that would burden each module both alone and in conjunction with other modules. In addition, we rated each package's suitability-to-task, a subjective score of how well a product approaches the power of popular standalone application programs.

For a system's database component, we created a database containing 250 records of employees with addresses and salary information, then imported an ASCII file in comma-delimited format. We subsequently performed sort, query, report, and output functions, taking note of any relational features or power-user capabilities such as searching on multiple fields.

After importing a .WKS-format worksheet file containing a sales breakdown by quarter per salesperson, we observed how well the spreadsheet portion of the package imported the included formulas. Once employee records were sorted on the spreadsheet's BONUS field, we printed a list of employees who did not qualify for a bonus. To test the graphics module, we created a vertical bar graph depicting three months of sales totals from the spreadsheet.

LOW-END INTEGRATED SOFTWARE: SUITABILITY TO TASK

How great a price do you pay in features when you choose a low-end integrated package over standalone products? *PC Magazine*'s suitability-to-task ratings provide one way to help you make that determination based on your own needs. If you need a product that offers as much number-crunching capability as, say, *Microsoft Excel* or *Lotus 1-2-3*—but it needn't include word processing features on the level of *WordPerfect*—these informed (though subjective) ratings should be part of your decision process. For a more complete picture of what each product offers, compare this information with that contained in the product reviews and features table.

The Tasks

Each package is rated for its usefulness in six areas. The first five—word processing, database, spreadsheet, graphics, and communications—compare the integrated package's appropriate modules against the best the industry has to offer. In the word processing category, the product must stack up against leading low-cost standalones like *Q&A Write* and *PFS:Professional Write* to merit a score of 4. For spreadsheet capability, it should rival leading products like *Lotus 1-2-3* and *Microsoft Excel* for a top score; for database strength, *Q&A* and *PFS:Professional File;* for communications, *Crosstalk* and *PC Talk;* and for graphics, *Harvard Graphics.*

The sixth score rates how well the package performs tasks that require data and functions from several modules working together. Tasks attempted for this score are mail-merge, desktop publishing, financial reports, and "The Travelmate." The last of these tests the software's ability to fit on one 3.5-inch diskette for laptop use and to accept data from major standalone programs.

The Ratings

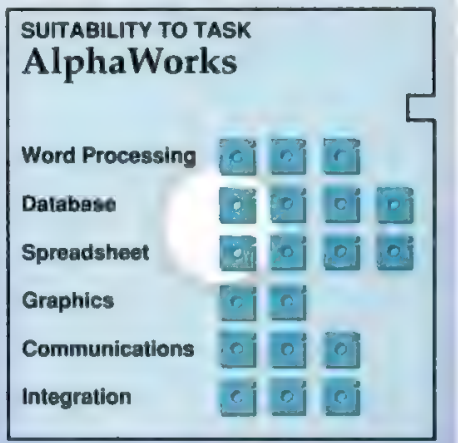
0 = No such capabilities offered.

1 = Poorly suited overall.

2 = Somewhat capable.

3 = Well suited.

4 = Excellently suited; rivals the standalone products specified above.



The word processing tasks had us import, format (using a package's best fonts, justification, boxes, and other features), and spell-check an ASCII file with a letter congratulating employees who earned bonuses; we also imported an ASCII-format table and the bar graph. Among other tasks, a mail-merge test printed the congratulatory letter that was to be mailed to each employee qualifying for a bonus.

To test a package's telecommunications module, when one was present, we logged onto MCI Mail and sent a copy of the first mail-merge letter. Any features for script languages, phone directories, and automatic redial were noted for inclusion in the review or summary of features.

In addition, each package was evaluated for how well it performed under duress—namely, features for the user on the go, traveling with a laptop. Could the package fit on one 720K 3.5-inch disk? Did it offer templates for commonly used business formats or offer a predefined database for, say, client contacts? What desktop utilities did it offer? These and other features can make all the difference for a professional away from the office.

WHICH TO CHOOSE?

Ordinarily, selecting a software product involves determining what features you need and how much power you can get for what you're willing to pay. But too often, integrated software purchases are viewed in a more negative sense—the decision is based on which features you're willing to give up. Perhaps both perspectives have their merits. Ultimately, your own needs, as well as the direction you see yourself heading, may be the best determinant.

There is no easy choice. For instance, even the low-end market leader, *PFS:First Choice*, offers plenty of attractive features across its gamut of modules, including a consistent interface and smooth data sharing. Its ease of use, in fact, is often enough to convince the potential buyer. But if you're mostly interested in a first-rate integrated word processor or spreadsheet—with less demand on other modules—you may opt for a product with greater strengths in these areas.

If the database must be top-flight, *AlphaWorks*' relational database seems an apparent choice. But what if you want the ability to export files to *Windows*-based programs like *Microsoft Excel*? Remember that the low end is not without its compromises.

And if graphical user interfaces (GUIs) are your thing, keep in mind that *Microsoft Works* is currently the only low-end product that conforms to IBM's Systems Application Architecture (SAA), which has already begun to standardize IBM hardware and software solutions. Other products are sure to follow suit in later versions.

No matter what your decision, you can at least feel confident that you're selecting a product from a market that's currently booming. While the high end of the market waits to see what kind of threat it faces from OS/2 (whose multitasking benefits may lure away some users), the low end faces only unimpeded growth.

Vendors have had to do plenty to restore the image of the integrated software, once the laughingstock of the PC industry. These products will demonstrate that the results are nothing to laugh at.

AlphaWorks

All reviews by Henry Fersko-Weiss

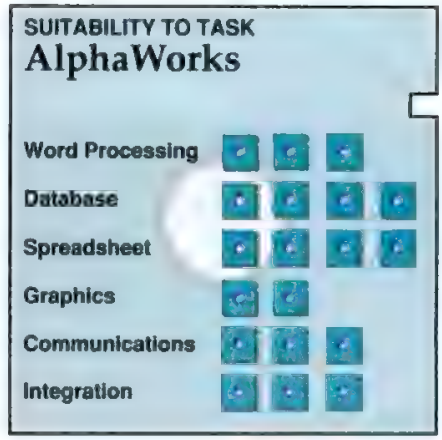
Although integrated programs are often labeled as entry-level or low-end packages, Alpha Software's *AlphaWorks* resists both classifications. Despite its low-end price of $195, this is a powerful, flexible product with an appealing look and solid integration. Its relational database, rich macro capabilities, and ability to have nearly 30 files open at once makes *AlphaWorks* an outstanding choice.

The program has all the flashy accoutrements of contemporary software design: pull-down menu boxes with an underlying shadow, pop-up dialog boxes, and user-defined colors.

It also gives you excellent control over the commonplace directory list. When choosing a file, you can filter the list using a wildcard command and sort it by filename or date in ascending or descending order.

Better yet, the View command opens a window displaying the first 13 lines of a file. It's like having X-ray vision—suddenly you can see through the wall of an eight-character filename right to your text or data without actually loading the file.

Other niceties include a split-screen feature and the ability to create user-defined menus with macros. Keyboard and shorthand macros are also available.



RELATIONAL POWER

Since the database service in *AlphaWorks* is relational, you can pull field values from one database into another without a permanent link between the two. This saves you from maintaining duplicate information in different places.

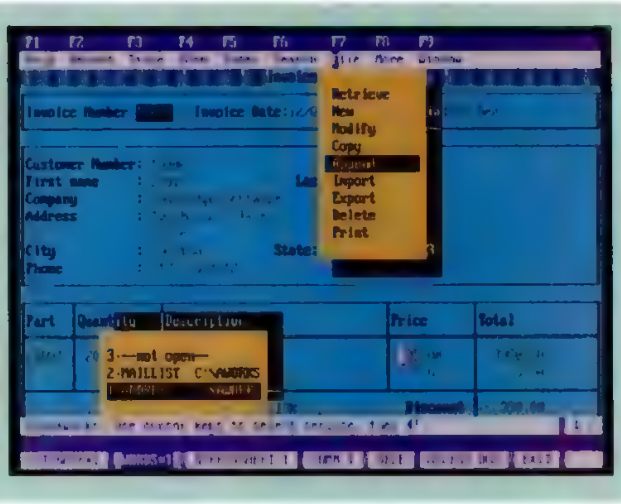
The power of the relational approach is demonstrated by an invoice application that comes with the program. As you fill out an invoice record, the database automatically draws on three other databases. One contains the names and addresses of customers, another has parts information, and a third houses discount data based on the size of a purchase.

Other fields in the invoice application reveal the tremendous flexibility built into *AlphaWorks*. The invoice number field is automatically incremented for each new record; a user-defined pop-up window offers shipping choices; calculated fields are represented; and several fields provide a list of acceptable possibilities and verify entries.

Putting these database features to work is not altogether a simple matter. You will have to write rules using keywords, IF clauses, operational symbols, and parenthetic phrasing. Although *AlphaWorks* helps slightly by supplying pop-up lists of rule types and field names, writing rule expressions takes time to learn.

Expressions or rules are also used to search the database. Search criteria can include the Boolean operators AND, OR, and NOT; a "sounds like" keyword; and range restrictions. Searches can be combined with indexes quickly to select and order records at the same time.

Creating complex searches is made easier through an automatic expression builder that uses the "query-by-example" technique. All you have to do is fill in a template with an example of what you want to find—for instance, everyone



The relational database in *AlphaWorks*, from Alpha Software Corp., lets you automatically bring data into a record from other databases. With the Append command, shown here, all the records from a second database can be brought in at once and attached to the end of the current file.

whose salary is over $30,000—and the search expression is written for you.

Other outstanding features include the ability to save an unlimited number of table view layouts, dial a telephone number from within a record, and perform batch updates.

The spreadsheet service was designed using some of the same philosophical tenets as the database. The database service and the spreadsheet service, for example, both use the most popular file formats: *dBASE III*'s .DBF and *Lotus 1-2-3*'s WKS/.WK1.

The spreadsheet features a high level of flexibility. You can protect cells from data entry or hide them from view, search for a text string in formulas or labels, conceal columns, perform recalculations in the background while you do other work, display numbers in different styles (currency, percentage, and so forth), choose from among six graph types, scale your graphs, and more.

WORD PROCESSING BASICS

The word processor provides basic text editing, type styling, and block commands, but the formatting features go a bit further. You can predefine up to eight rulers with margins, tabs, and line spacing, and then apply these as many times as you like. The combination of rulers and a page format from any document can be retrieved and applied to a new document. This gives you a quick way to set formats or to update them.

Beyond the editing and formatting functions, the word processor weakens. You can't change type fonts or point sizes. You can't see bold or italic print on the screen—the words will only appear highlighted in different colors. Finally, you can't mix text and graphics.

On the plus side, you can easily move individual field information, records, or whole databases into a word processing document using cut-and-paste operations and copy commands. It's just as easy to move bits of data from a spreadsheet or the entire worksheet.

This soundly integrated system provides additional goodies for anyone with enough memory. You can juggle nine open files in each service (except for communications, where only two can be open). Jumping from one file to another is quick using the shortcut keys, or you can use the menus. When you return to a file, you're right back where you left off—you might almost feel that you're multitasking.

AlphaWorks is a powerful program at a low price. The database and spreadsheet functions in particular give you comprehensive and flexible control over your information. This is the kind of program that will not only satisfy entry-level users but will accommodate them as their experience grows and their needs mature.

FACT FILE
EDITOR'S CHOICE

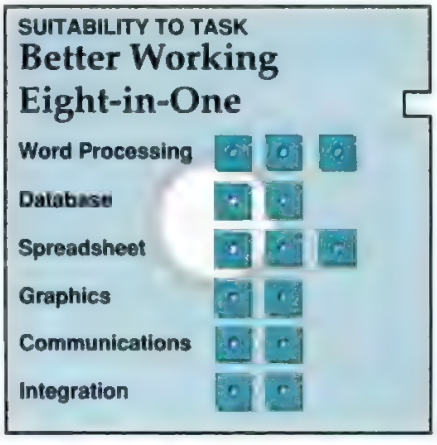
***AlphaWorks*, Version 2.0**
Alpha Software Corp., One North Ave., Burlington, MA 01803; (617) 229-2924.
List Price: $195.
Requires: 512K RAM, two floppy disk drives or hard disk drive with 1MB available space, DOS 2.0 or later.
In Short: An outstanding product, *AlphaWorks* allows up to 29 open files at once and has a potent relational database, plus excellent macro facilities. Weaknesses include lack of fonts and other sophisticated word processing features.

CIRCLE 403 ON READER SERVICE CARD

Better Working Eight-in-One

The name of Spinnaker Software Corp.'s $59.95 program sounds presumptuous, a smug assertion of accomplishment. As it turns out, however, the name *Better Working Eight-in-One* for the most part is no brag—just fact.

The package offers the major applications: word processing, spreadsheet, database, graphics, and communications. There's also an outliner, memo pad, address book, world clock, calendar, to-do list, label-maker, and calculator. While Spinnaker has sacrificed functional depth to provide all these features at an affordable price, it has surrendered nothing in ease of use.



Eight-in-One's opening screen has a main menu bar with an information line above to explain menu choices. Below these two lines, the screen is black—the first sign of one place Spinnaker has skimped: screen design. Besides this barren DOS-like background, input boxes are primitively styled, some status areas seem crowded, and other design elements are plain.

But if the screens aren't modern, the command system is. You invoke menu selections by typing the initial character, and *Eight-in-One* also lets you use shortcut keys or mouse clicks for almost every command. File choices, database field names, and other list selections can be

made from pop-up directories. This combination of command tools makes the program easy to use and fast—although the shortcut keys take time to master, because they aren't listed on the menus.

NO-FRILLS APPLICATIONS

The applications in *Eight-in-One* are basic. In the database, you can see only a form view of your records, so you have to look at one record at a time. You can't do multiple field searches in the database itself—only in reports. The spreadsheet doesn't support the AND and OR logical operators in imported files. There are only six graph types. The outliner doesn't let you collapse and expand levels. And you're restricted to just ten recorded log-on procedures in the communications application.

You'll find, however, several anomalies to this picture of stripped-down functionality. The spreadsheet gives you a work area that is 32,768 rows by 10,000 columns—the largest available among the seven programs we review here. In the world clock, one of the utilities under the desktop applications menu, you can automatically see the time in 16 different cities around the world and use a stopwatch, timer, or alarm. The word processor allows you up to 32 formats in a document and has a WYSIWYG page previewer.

Of all the applications, the word processor is probably the richest. In addition to basic editing and block functions, you can choose from up to nine fonts and a range of type styles, including bold, italic, and even a continuous underline. The word processor provides a word count and comes with a 100,000-word dictionary and a thesaurus.

Eight-in-One's database allows you up to 128 fields in an unlimited number of records. There are five choices of field type: character, numeric, date, logical, and memo. Field data can be restricted by logical operators—such as "more than" or "equal to"—or by calculations using basic math functions.

Each database can have three index fields, which you use to create one sort view of the records at a time. (More-powerful sorting and selection features are reserved for the report function.) Here you can do multiple field selection using logical or mathematical criteria and do a three-tiered sort. But all the sorts have to be in the same order—either ascending or descending.

You can save ten reports for each database. The reporting features will allow you to do basic customizing of fields and page layouts, but they won't let you get particularly creative.

HUGE SPREADSHEET

There's nothing fancy about the spreadsheet in *Eight-in-One*, except for its potentially huge size. Of course you do get to manipulate blocks or ranges of cells, you can turn recalc on or off, and you can lock row and column titles onto the screen. You can import .WKS, .WK1, .DIF, or *Eight-in-One* file types. But untranslatable formula expressions, such as AND, will result in empty cells.

From within the spreadsheet, you can produce six different graph types: bar, line, shaded line, pie, exploded pie, and scatter; these are the same types available in the graphics application. Clearly there are some important missing graph types, such as a combined line and bar chart, a stacked bar chart, and a high/low/close graph. You're restricted to three data ranges and 150 data points as well.

In addition to the major applications, *Eight-in-One* includes a host of desktop utilities. Most of them are rather simple, but a few, like the monthly calendar display with a reminder feature, the address book, and the world clock, are useful and even fun.

NO EASY INTEGRATION

When it comes to tying all the applications together, it takes some awkward keyboard work. You can't simply cut-and-paste among the database, spreadsheet, and word processor. And each connection requires a different technique. To get spreadsheet data into a word processing document, for example, you have to print it to a file and then read it in, whereas getting data from the database to a document requires embedding @merge statements.

Two other weaknesses in the program are the lack of macros—except for communications log-ons—and the inability to use windows. You can have two word processing documents open at once, but that's it. You can move back and forth to view the last open file in each application category, but you're returned to the top of the file, not the place you left off.

Better Working Eight-in-One has some obvious feature and design flaws. Yet, because of its broad functionality, it's a good program for the user who wants everything in one package for little expense—and doesn't demand great things from any individual application.

PC FACT FILE

***Better Working Eight-in-One*, Version 2.0**
Spinnaker Software Corp., One Kendall Square, Cambridge, MA 02139; (800) 826-0706, (617) 494-1200.
List Price: $59.95 (5 25-inch disks); $64.95 (3 5-inch disks); $69.95 (both 5.25-inch and 3.5-inch disks).
Requires: 512K RAM, two floppy disk drives or hard disk with 1.6MB available space, DOS 2.0 or later.
In Short: For the price, *Better Working Eight-in-One* has a broad array of features for mostly entry-level buyers. Some of them, such as the WYSIWYG Preview mode and extremely large spreadsheet, are admirable. But other program elements are limited, screen design is unsophisticated, and integration is convoluted.

CIRCLE 404 ON READER SERVICE CARD

Better Working Eight-in-One, from Spinnaker Software, lets you represent numbers in one of six graph types. After you've chosen a graph type, picked data points, and added labels, you can use this command on the Graph menu to view your graph before printing or exporting it.

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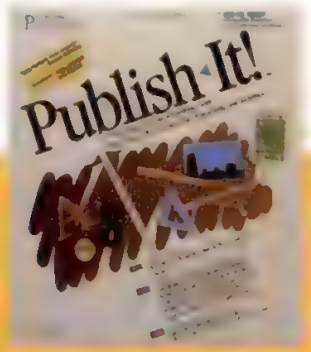

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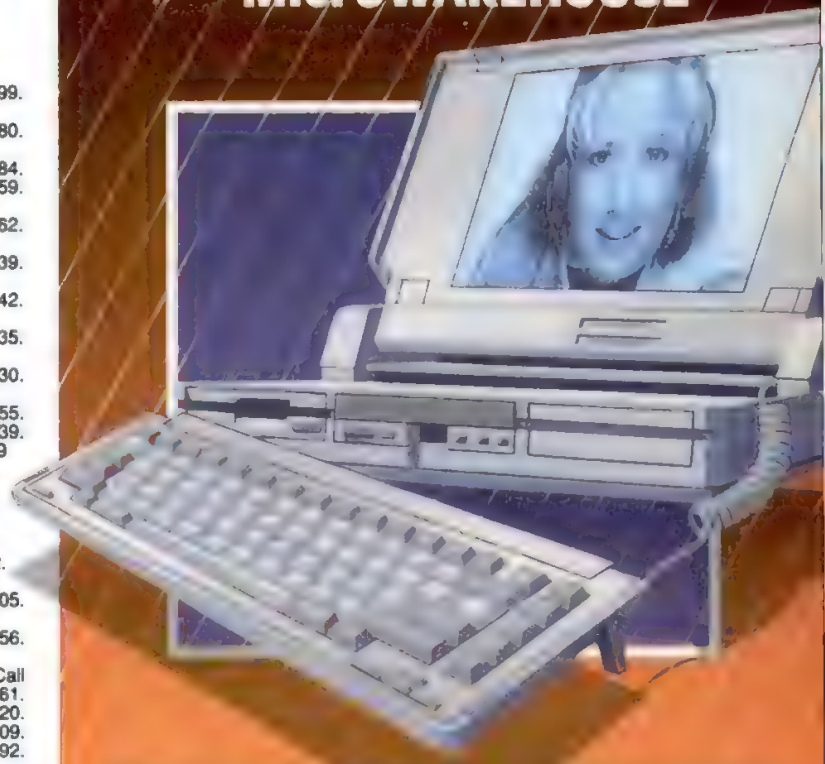

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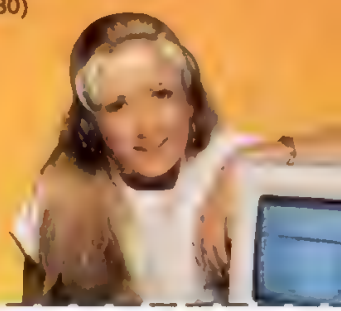

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CONTEST RULES **1.** Entries must be received on or before 1/31/90 **2.** Winner selected in random drawing by attorneys for Micro Warehouse Inc., (MWH), whose decisions are final. **3.** Prize subject to availability. MWH reserves the right to substitute wholesale cash value up to $5,000. **4.** Winner responsible for taxes. **5.** Odds of winning depend on number of entries **6.** MWH will announce the winner on or around 2/28/90. Winner will be notified by mail. Dates subject to change at the discretion of MWH. If unable to contact any winner, an alternate will be selected by random drawing. **7.** Contest is open to US residents, except where prohibited by law. Employees of MWH and suppliers not eligible. **8.** Prize - one Compaq SLT 286 w/640K RAM and 40Mb Hard Drive

DESKTOP PUBLISHING & GRAPHICS

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Corel DRAW! 1.1 (Corel Systems)
This powerful yet easy to use illustration package features lightning speed, over fifty precision fonts of any size, interactive kerning, bitmap support, excellent import/export support, clip art, macros and much more! **$315.**

ENTERTAINMENT & EDUCATION

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Kensington
Masterpiece Plus ..... 95.
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Bernoulli II/44Mb Int ..... 992.
Procom Technology
3 1/2" 1.44Mb Ext(AT) ..... 249.
Teac
3 1/2" 1.44Mb AT Floppy Drive .... 109.
5 1/4" 1.2Mb Floppy Drive ..... 89.

PRINTERS & CARTRIDGES

Canon
LBP-8III Laser ..... 1645.
LBP-4 Laser ..... 979.
Pacific Data Products
1-2-4 Memory Bd w/ 2mg ..... 499.
25 Cartridges in One! ..... 269.
Pacific Page ..... 495.
Panasonic
KX-P1124 Dot Matrix ..... 329.
KX-P1191 Dot Matrix ..... 228.

Wealthbuilder (Reality Tech.)
Ease your climb to increased wealth and financial security with Wealthbuilder by Money magazine. Investor advice that takes into account your personal aims, risk tolerance and financial profile. Now bundled with Quicken, the pair make up a most powerful money management, investment analysis tool. **$149.**

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Mouse w/Wndws & Paint(bus/ser) 131.
MicroSpeed
FastTRAP (bus/ser) ..... 104./94.
PC Trac (bus/ser) ..... 85./75.
Microtek Lab
Scanner MSF-300G ..... 1495.
The Complete PC
Half-Page Scanner 400dpi ..... 183.

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Goldstar
14" Analog VGA ..... 379.
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Panasonic
Panasync C1391 ..... 579.
Zenith
ZCM 1490 14" Flat Screen ..... 599.

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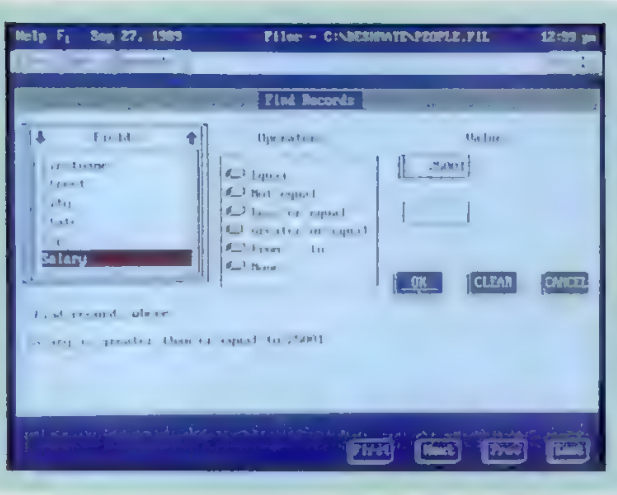
Generic CADD Lvl.3 w/Dot Plot ... 155
MathSoft
MathCAD 2.5 285

Scanman Plus (Logitech)
Logitech's Scanman Plus makes it easy to integrate text and images on your computer. Scan in images, edit them and use in your applications. Feature rich, the Scanman Plus enables you to adjust resolution between 100 and 1400 dpi, display images in 32 shades of gray and choose a line art setting and three patterns for photos. The Scanman Plus is designed to be your personal tool to be used right at your desk **$178.**

DeskMate



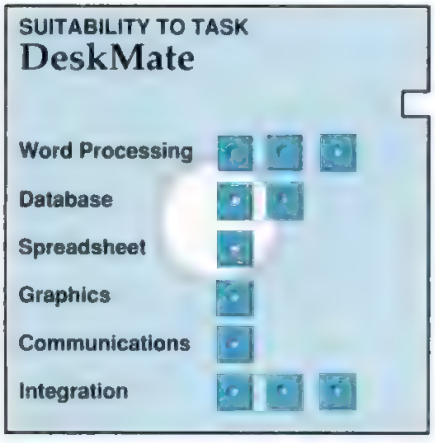
Tandy Corp.'s *DeskMate* allows you to search a database using logical operators. Here, a search has been set up to find all records where an employee's salary is greater than or equal to $25,000. A search can have multiple critena as well.

PHOTOGRAPHY: THOM O'CONNOR

It's clear by just flipping through the manual that Tandy Corp.'s $99.95 *DeskMate* is targeted mostly at the home market. The manual has a magazine-style layout and is illustrated with watercolor drawings. Nearly every application example revolves around home or social activities.

The screens in *DeskMate* also seem designed to appeal to the home user. The address book and phone list screens have input forms that look like loose-leaf pages in a bound book. The inventory database in the Filer program has a record form shaped like a tabbed index card. All the screens use bright primary colors and have borders and backdrops that appear textured. Menu buttons have pen-and-ink-style shading to give them a three-dimensional look, and they seem to push in when you use them.

The buttons on the main menu lead you to nearly 20 programs and tools that are well suited for home applications. Besides the word processor, spreadsheet, database, and communications modules, you get an address book, phone list, calendar, memo pad, to-do list, drawing program, and more.



You even get a computerized version of Hangman—all in all, quite an offering for the program's price.

What *DeskMate* gives you in breadth of features, however, it takes away in power. The spreadsheet is limited to 99 rows by 99 columns and has only 16 functions. A database record can't have more than 20 fields. The word processor has only bold and underline type styles, won't do more than double-line spacing, and can't set tab stops.

Despite its weaknesses, the word processor may actually be *DeskMate*'s best application. It has a fairly complete set of block move and edit features, margins that you can adjust as frequently as you like, search-and-replace, headers and footers, and a spelling checker. Also, you get to see bold and underlined text on the screen, as well as pictures from the draw application.

The word processor's features make it fine for letter writing, memos, and simple reports. If it had fuller line justification, a more complete set of type styles, the ability to set tab stops, and better line-spacing options, the module would be more useful to users whose needs have outgrown the beginner stage.

TWO-FACE DATABASE

DeskMate's database facilities are split between two programs: Filer and Formset. You add and view records in Filer and set up database forms in Formset.

When you create a database, you can put record fields wherever you like on the form; these fields must be defined for character or number data. They don't need further definition, but you can add format symbols, like the dollar sign, commas, a decimal point, or the percentage sign.

One of the nice things about *DeskMate* is the ability to pull pictures from the draw program into Formset. This lets you design special-looking formats, such as a file card, and include clip art or a drawing. The draw function also lets you enter title text in Roman, Modern, or System type fonts. In addition, you have a choice of three character sizes.

Records are added to a database in Filer. You can't import files—not even ASCII files—so all your database records have to be entered from scratch. This is quite a drawback if you already have database records in another program and want to transfer them over to *DeskMate*.

You can sort records by any number of fields at once—although only in ascending order. Searches can have multiple-field criteria using logical operators. To be selected, a record has to fit all the criteria.

All in all, the database functionality is limited. You can't get calculated fields, merge databases together, verify data entries, or create reports.

FEW FORMULA FUNCTIONS

The spreadsheet application in *DeskMate* is similarly limited. Besides its small capacity, it offers few formula functions. Missing are the functions that do future value, lookup, IF, internal rate of return, net present value, true/false, and variance.

Other holes in the spreadsheet include

FACT FILE

***DeskMate*, Version 3.3.1**
Tandy Corp., 1800 One Tandy Center, Fort Worth, TX 76102, (817) 390-3700
List Price: $99 95
Requires: 384K RAM (ROM-based machine) or 512K RAM (640K RAM recommended), graphics adapter, DOS 2.11 or later
In Short: Sporting the most applications and desktop tools of any low-end product, *DeskMate* also offers graphically oriented screen design and a partial WYSIWYG display. But general limitations in functionality render it most suited for personal home use; for example, the spreadsheet has only 99 rows by 99 columns.

CIRCLE 405 ON READER SERVICE CARD

LOW-END INTEGRATED SOFTWARE: SUMMARY OF FEATURES

(Products listed in ascending price order)

The following commentary analyzes some of the terms and phrases in this table of features; it also includes comments about related traits that all of the packages have in common. The phrases in bold type are listed in the same order as in the left-hand column of the table.

GENERAL FEATURES

Can create shell for other applications A yes answer indicates that the package lets you add an outside application as a main-menu entry and launch into that application from the main menu.

Maximum number of active windows indicates how many display regions can be opened and kept active in memory simultaneously. Tandy's *DeskMate* must be used in its task-switching mode to have two files open at the same time.

Maximum number of active applications indicates how many separate program modules can be opened simultaneously. Modules include word processing, database, spreadsheet, communications, and graphics. Tandy's *DeskMate* must be in its task-switching mode to run two applications simultaneously.

Uses place markers while moving among applications Some programs let you keep the cursor in place within a file, even when you leave the file and later return. Again, *DeskMate* allows the use of place markers only in its task-switching mode.

File handling All of the packages let you copy and delete files. All provide some kind of drop-to-DOS function, and each one can supply a directory of filenames.

Device support All of the packages support the common display adapters–CGA, EGA, VGA, and Hercules–except that *PRO Staff* does not support VGA. All of the packages support a variety of dot matrix printers and the HP LaserJet II.

WORD PROCESSOR

None of these packages can create documents with multiple columns. Each one supports a single, built-in typeface, available in a number of fonts such as italic and bold.

Holds all pages in memory If the entire document is held in active RAM, the document is limited to the amount of available memory. Some packages spool excess pages to disk instead.

Allows multiple documents open simultaneously Each yes answer is followed by the number of word processing display regions that can be open in active memory at one time.

Keeps paragraphs on single page Some packages allow you to ensure that a paragraph is never split across two pages. This capability can be structured to prevent widows and orphans. In this context, the first line of a paragraph is called an *orphan* if it appears alone at the bottom of a page. A *widow* is a paragraph's last line appearing alone at the top of a page.

Tabs All of the packages reviewed provide standard (left) tab stops. The word *all* indicates that a package can also create center tabs (around which text is centered), right tabs (with text moving left from each tab), and decimal tabs (where columns of numbers can be aligned).

Maximum screen lines for displaying document indicates the number of lines available in the work area with the normal display mode selected. *Microsoft Works* also supports enhanced (43- or 50-line) displays.

WYSIWYG There are varying degrees of WYSIWYG ("What You See Is What You Get"), which implies that the display screen matches the printed output. A yes answer indicates that the program can display (either in a preview mode or during editing) true on-screen fonts, pagination, headers and footers, margins, and line spacing. If the answer is *partial*, the program can display most but not all of these attributes.

Block commands All of the packages can treat a defined block of text as a unit for deleting and undeleting. With the exception of *PRO Staff*, they can all save a block of text as a separate text file and move or copy a block to another existing file.

Direct data exchange means that the program can move data between its various modules without any intermediary file conversion or export step.

Hyphenation means that the program can automatically hyphenate words at ends of lines, using either a built-in dictionary or a hyphenation algorithm.

Corporate and professional features All of the packages can perform mail-merge activities; none can create an indexed document.

Template documents are special files containing format settings that can be applied to text.

Document summary indicates that the program can produce a profile of each document, including the author's name, the date of creation, a description, and often the revision number. Since *AlphaWorks* uses its database as a full-fledged word processor, it can maintain a document summary.

DATABASE

Maximum field size indicates the permissible number of characters in an alphanumeric field.

Maximum number of records per data file The maximum size of a data file is based on a program's fixed limitation or on the maximum number of average-size records.

Painting is the ability to place a field anywhere on the screen to create a data entry form.

Automatic field-name placement means that the program automatically puts the specified database fields in fixed positions on the screen.

Data field types All packages reviewed support character and numeric fields.

All occurrences All of the packages can search for the first occurrence of a specified string, but only some of them can search the database for every occurrence of that string.

Can paint screen for report means that the package lets you design a free-form printed report by placing database fields where you choose.

SPREADSHEET

Named ranges A yes answer means that a region of the spreadsheet can be stored and given a single plain-English name. Such names can be used in place of the conventional cell references in formulas, functions, and commands.

Split windows A yes answer means that you can partition the spreadsheet vertically or horizontally so that you can work with at least two distinct areas of spreadsheet data independently.

File import and export All packages support ASCII import; none support *Microsoft Excel*'s .XLS format.

Number of functions Because each package uses its own scheme for classifying spreadsheet functions, we provide a total count of available functions (not including operators such as +, -, *, and /). All of the packages support mathematical, trigonometric, and statistical functions, but they differ in their support of logical, financial, and date functions. If you need particular functions, be sure to check before making a purchase.

Printing All of the packages can print spreadsheets larger than 80 columns wide. None can create shaded areas or boxes within a spreadsheet.

GRAPHICS

Built into spreadsheet A yes answer means that the program can take spreadsheet data and convert it into a graph from within the spreadsheet module (as does *Lotus 1-2-3*, Version 2.0).

Standalone module A yes answer means that the graphics component is not a subset of the spreadsheet component. The graphics component is a standalone module with either charting or drawing capabilities (drawing capabilities would include lines, boxes, ellipses, and so on).

Dynamic links to spreadsheet are active, logical connections from the spreadsheet's data file to the graphics. If the spreadsheet data changes, the graph will automatically reflect that change.

File import and export None of these packages can import or export graphics from other standard file formats. Because *Better Working Eight-in-One*'s native format is .PCX, it will work with other .PCX files. *PFS:First Choice* can exchange data with other Software Publishing Corp. programs: *Harvard Graphics*, *PFS:First Publisher*, and *PFS:Professional Write*.

Chart types Horizontal- and vertical-bar-chart support may include variations like cumulative bar charts and stacked bar charts. Pie charts may include exploded pie charts.

Drawing tools provide the ability to create graphics primitives like lines, boxes, ellipses, and polygons.

Graphics manipulation means that you can modify an image using commands such as size, rotate, flip, duplicate, overlay, and zoom.

COMMUNICATIONS

Automatic log-on script creation All of the programs that have communications modules can create an automated procedure for logging onto another computer or service.

Transmission rates All of the packages with communications modules support the common transmission rates of 300, 1,200, 2,400, and 9,600 bits per second. *Better Working Eight-in-One*, however, supports only 9,600 bps in a direct machine-to-machine mode.

Hayes extended command set All of the packages support the Hayes standard command set for modems.

File transfer protocols None of the programs support any type of CompuServe protocol or Modem 7 protocol.

	PRO Staff	Better Working Eight-In-One	DeskMate	Microsoft Works	PFS:First Choice	AlphaWorks	Integrated 7 Advanced
List price	$59.85	$59.95 ($64.95 for 3.5-inch disks)	$99.95	$149.00	$159.00	$195.00	$199.00
GENERAL FEATURES							
Total disk space used by installed package	300K–800K	1.6MB	2MB	1.1MB	1.3MB	1MB	2MB
Shipped with 5.25-inch or 3.5-inch disks	5.25-inch	Both (for $69.95)	Both	Either	Either	Both	Either
Number of 5.25-inch/3.5-inch disks	5/not available	5/3	7/4 (3 in ROM-based PC)	8/4	4/2	5/3	6/3
Can create shell for other applications	■	❑	■	■	■	❑	❑
Network version available (number of users)	❑	❑	■ (2 with RS-232, 32 with Tandy-Link, 100 with 3Com 3Plus)	■ (One user minimum)	■ (5)	❑	❑
Command strategy:							
Lotus-style menus	❑	❑	❑	❑	❑	■	■
Command line	❑	■	❑	❑	❑	❑	❑
Key combinations	❑	■	■	■	■	■	■
Can be automated through macros	❑	■ (Communications only)	❑	■	■	■	■
Windowing capabilities:							
Maximum number of active windows	1	2 (Word processor only)	2	8	1	29	4

Ⓔ—Editor's Choice ■—Yes ❑—No

CONTINUES

LOW-END INTEGRATED SOFTWARE: SUMMARY OF FEATURES

(Products listed in ascending price order)

	PRO Staff	Better Working Eight-in-One	DeskMate	Microsoft Works	PFS:First Choice	AlphaWorks	Integrated 7 Advanced
Maximum number of active applications	1	1	2	4	1	4	4
Uses place markers while moving among applications	❑	❑	■	■	■	■	■
File handling:							
Can rename files	❑	■	■	■	■	■	■
Makes automatic backups	■	❑	❑	■	❑	❑	❑
File access security	❑	❑	❑	❑	❑	❑	■ (Spread-sheet only)
Device support:							
Mouse	❑	■	■	■	■	■	❑
Plotters	❑	❑	❑	■	■	❑	■
Printers							
PostScript	❑	❑	❑	■	❑	■(Graphics only)	❑
Color	■	❑	❑	■	■	❑	■
Desktop accessories:							
Calendar	❑	■	■	❑	❑	❑	❑
Phone directory	❑	■	■	❑	❑	❑	❑
Date book	❑	■	■	■(For alarm only)	❑	❑	❑
Calculator	❑	■	■	■	■	❑	❑
Alarm	❑	■	■	■	❑	❑	❑
Other	None	Label maker, notepad, to-do list, world clock	Notepad, to-do list	Phone dialer	None	Phone dialer	None
Help:							
On-line tutorial	❑	❑	■	■	❑	❑	❑
Disk or printed tutorial	❑	■	■	❑	■	■	■
Quick reference card	■	■	❑	■	■	■	❑
WORD PROCESSOR							
General features:							
Maximum size of document	500K	Limited by RAM	50K	Limited by disk capacity	54K	64K	Limited by RAM
Holds all pages in memory	❑	■	■	❑	■	■	■
Allows multiple documents open simultaneously (number)	❑	■(2)	❑	■(8)	❑	■(9)	❑
Text formatting:							
Variable page length within document	■	■	■	■	■	■	❑
Variable line spacing within document	■	■	■	■	■	■	❑
Keeps paragraphs on single page	■(Widow/orphan control)	■	❑	■	❑	❑	❑
Creates headers and footers	■	■	■	■	■	■	■ (Single-line only)
Tabs	All	Left only	Left only	All	Left only	Left only	Left only
Bullets	❑	❑	❑	■	■	❑	❑
Screen displays:							
Maximum screen lines for displaying document	22	21	21	20	20	25	20
WYSIWYG	❑	■	■ (Partial)	■	❑	❑	❑
Graphics displayed	❑	■	■	■	❑	❑	❑
Displays on-screen ruler	■	■	❑	Optional	Optional	■	❑

—Editor's Choice ■—Yes ❑—No

CONTINUES

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MAN LOSES HAIR WAITING FOR DOS

Anytown, USA—The unidentified victim was apparently among the millions of people who still think that DOS Backup and Copy commands are a safe and convenient way to back up their valuable hard disk data.

It is not known whether the shocking loss was a result of natural aging while DOS made the backup, or whether the victim pulled his hair out in frustration after discovering that a minor disk error had rendered his entire backup set useless.

According to reliable sources, the tragedy could have been averted if the man had been using **FASTBACK PLUS**, the world's fastest and most reliable backup software.

A special commission has been appointed to study ways in which the public can be made aware that **FASTBACK PLUS**' *Advanced Error Correction, easy-to-use menu, flexible file and directory selection, automated backup options* and other features allow even beginners to make fast, foolproof backups.

Public knowledge of these facts could ease the widespread stress and trauma that result from using DOS commands to back up hard disk data.

This product is in no way associated with or has origination in Fisher Scientific or Allied Corporation

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CIRCLE 232 ON READER SERVICE CARD

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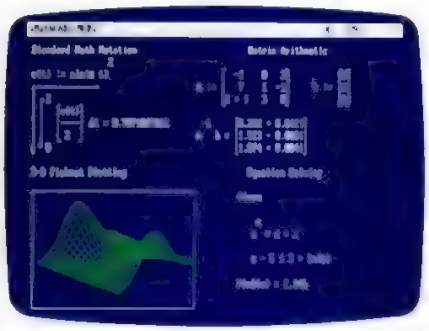

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PC MAGAZINE EDITORS' CHOICE
March 14, 1989 issue.
Best of '88
Best of '87

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U.K.: Adept Scientific 0462-480055; **France:** ISE CEGOS 1-46092768; **Germany:** Softline 07802-4036; **Japan:** CRC 03-665-9768.

PE

CIRCLE 154 ON READER SERVICE CARD

LOW-END INTEGRATED SOFTWARE: SUMMARY OF FEATURES

(Products listed in ascending price order)

	PRO Staff	Better Working Eight-in-One	DeskMate	Microsoft Works	PFS:First Choice	AlphaWorks	Integrated 7 Advanced
Status indicator line:							
Line number	■	■	■	❑	■	■	■
Column number	■	■	■	❑	❑	■	■
Filename	❑	❑	■	■	■	■	■
Current drive and path	❑	❑	❑	❑	❑	■	■
Text entry and editing:							
Block commands	❑	■	■	■	■	■	■
Maximum size of block	2,000 characters	Limited by RAM	Limited by RAM	Limited by disk capacity	64K	64K	Limited by RAM
Search and replace:							
Works forward and backward	❑	■	❑	❑	❑	❑	■
Performs global replace	■	■	❑	■	■	■	■
Uses wildcards	■	■	❑	■	❑	❑	❑
Performs case-sensitive search	■	■	❑	■	❑	■	■
Direct data exchange:							
To and from spreadsheet	❑	■	■	■	■	■	■
To and from database	■(From only)	■	■	■	■	■	❑
To and from graphics	N/A*	■	■	■(From only)	■	■	❑
File import and export formats:							
DCA	❑	❑	❑	■	■	❑	❑
Microsoft Word	❑	❑	❑	■	■	❑	❑
WordPerfect	❑	❑	❑	❑	■	❑	❑
WordStar	❑	❑	❑	❑	■	❑	❑
MultiMate	❑	❑	❑	❑	■	❑	❑
Other	❑	❑	❑	RTF (Rich Text Format)	*PFS:Professional Write*, RTF, Wang PC	❑	❑
Tools:							
Word count	❑	■	❑	❑	❑	■	❑
Spell-checking:							
Number of words in dictionary	26,000	100,000	90,000	100,000	75,000	100,000	80,000
Spell-checks single word	❑	■	■	■	■	■	■
Spell-checks defined block	❑	❑	■	■	■	■	■
Hyphenation	■	■	❑	❑	❑	❑	❑
Thesaurus	❑	■	Optional ($29.95)	■	■	■	■
Corporate and professional features:							
Footnotes and endnotes	■(Footnotes only)	❑	■	■(Endnotes only)	❑	❑	❑
Table of contents	■	■	❑	❑	❑	❑	❑
Outlining	❑	■	❑	❑	❑	❑	❑
Template documents	■	■	❑	■	■	■	❑
Hidden comments	■	❑	❑	❑	❑	❑	❑
Document summary	❑	❑	❑	❑	❑	■(Using database)	❑
Draft print	■	■	■	■	■	■	❑
DATABASE							
File structure:							
Maximum field size (characters)	30	256	1,000	256	21,504	254	60
Maximum fields per record	40	128	20	255	4,000	128	40
Maximum records per data file	Limited by disk capacity	Limited by disk capacity	30,000	4,096	64K	Limited by disk capacity	Limited by disk capacity

[■]—Editor's Choice ■—Yes ❑—No

N/A*—Not applicable: PRO Staff does not have graphics and communications modules.

CONTINUES

LOW-END INTEGRATED SOFTWARE: SUMMARY OF FEATURES

(Products listed in ascending price order)

	PRO Staff	Better Working Eight-In-One	DeskMate	Microsoft Works	PFS:First Choice	AlphaWorks	Integrated 7 Advanced
Maximum number of open data files	1	1	1	8	1	9	1
Record creation:							
Painting	■	■	■	■	■	■	❑
Automatic field-name placement	❑	❑	■	❑	❑	■	■
Data field types:							
Currency	■	❑	❑	■	❑	❑	❑
Date	■	■	❑	■	■	■	■
Boolean	❑	■	❑	■	■	■	❑
Direct data exchange:							
To and from spreadsheet module	❑	■	■	■	■	■	■
To and from word processor	■ (To only)	■	■	■	■	■	❑
Data import and export:							
From and to .DIF	■ (To only)	❑	❑	❑	❑	■	❑
From and to ASCII	❑	■	❑	■	■	■	❑
Data manipulation:							
Maximum number of indexed fields	20	3	5	N/A[1]	N/A[1]	7	40
Data files can be joined	❑	■	❑	❑	■	■	■
Sorting:							
Sorts on any field	■	❑ (Indexed fields only)	■	■	■	❑ (Indexed fields only)	■
Sorts in ascending or descending order	Ascending	Ascending	Ascending	Both	Both	Both	Both
Search parameters:							
All occurrences	■	❑	■	■	■	■	■
Index field only	■	❑	❑	❑	❑	❑	❑
Multiple fields (maximum number)	■ (12)	❑	■ (All)	■ (All)	■ (All)	■ (254-byte limit)	■ (40)
Wildcard or string segment	❑	■	■	■	■	■	■
Mathematical and statistical functions	❑	■	■	■	■	■	❑
Report generation:							
Can paint screen for report	■ (In word-processor)	■	❑	❑	❑	❑	❑
Mailing labels	■	■	❑	■	■	■	■
SPREADSHEET							
Spreadsheet size (rows x columns)	256 x 256	32,768 x 10,000	99 x 99	4,096 x 256	1,024 x 768	8,096 x 256	8,192 x 256
Worksheet features:							
Named ranges	❑	❑	❑	■	❑	■	■
Maximum number of open spreadsheets	1	1	1	8	1	9	1
Split windows	❑	❑	❑	■	❑	■	■
Hidden columns	❑	❑	❑	■	❑	❑	■
Cell protection	■	■	❑	■	❑	■	■
Merge spreadsheets	❑	■	■	■	❑	■	■
Direct data exchange:							
To and from database	❑	■	■	■	■	■	■
To and from graphics	❑	■	❑	■ (To only)	■	■	■
File import and export:							
From and to .WK1	❑	■	❑	■	■	■ (Native format)	■
From and to .WKS	❑	■	❑	■	■	■ (From only)	■
From and to .DIF	■	■	❑	❑	❑	■	■

—Editor's Choice ■—Yes ❑—No

N/A[1]—Not applicable: the product does not index fields.

CONTINUES

LOW-END INTEGRATED SOFTWARE: SUMMARY OF FEATURES

(Products listed in ascending price order)

	PRO Staff	Better Working Eight-in-One	DeskMate	Microsoft Works	PFS:First Choice	AlphaWorks	Integrated 7 Advanced
	44	50	16	56	72	77	74
Number of	■	❑	❑	■	■	■	■
Logi	■	■	❑	■	■	■	■
D	■	■	❑	■	■	■	■
or column	Both	Neither	Neither	Row	Neither	Row	Row
landscape	■	❑	■	■	■	■	❑
defined range	■	■	■	■	❑	■	■
CS							
to spreadsheet	N/A*	■	❑	■	■	■	■
dalone module	N/A*	■	■	❑	■	❑	❑
a exchange:							
To and from database	N/A*	❑	■	❑	■	■	■
To and from word processor	N/A*	■	■	■ (To only)	■	❑	■
To and from spreadsheet	N/A*	■	❑	■ (From only)	■	■	■
Dynamic links to spreadsheet	N/A*	❑	❑	■	■	❑	❑
File import and export							
From and to .WK1	N/A*	❑	❑	■	❑	■ (Native format)	■
From and to .WKS	N/A*	❑	❑	■	❑	■ From only	■
From and to .DIF	N/A*	❑	❑	❑	❑	■	■
From and to ASCII	N/A*	❑	❑	■	■	■	■
Chart types:							
Text	N/A*	❑	❑	❑	■	❑	■
Tables	N/A*	❑	❑	❑	■	❑	❑
Vertical bar (column)	N/A*	■	❑	■	■	■	■
Horizontal bar	N/A*	❑	❑	❑	❑	❑	■
Pie	N/A*	■	❑	■	■	■	■
Line	N/A*	■	❑	■	■	■	■
Area	N/A*	■	❑	■	■	❑	❑
3-D	N/A*	❑	❑	■	❑	❑	❑
Other	N/A*	Scatter	None	High-low-close	Curve, high-low-close, scatter, trend	None	Scatter
Chart capabilities:							
Automatic legends	N/A*	■	❑	■	■	■	■
Combination charts	N/A*	❑	❑	■	■	❑	■
Multiple y-axes	N/A*	❑	❑	■	❑	❑	■
Drawing tools	N/A*	❑	■	❑	❑	❑	❑
Graphics manipulation	N/A*	❑	■	❑	❑	❑	❑
COMMUNICATIONS							
Automatic log-on script creation	N/A*	■	■	■	■	■	■
Automatic redial	N/A*	❑	❑	❑	■	■	❑
Unattended file transmission	N/A*	❑	❑	❑	■	■	❑
Modem support:							
Transmission rates	N/A*	All	All	All	All	All	All
Hayes extended command set	N/A*	❑	❑	❑	■	■	❑
File transfer protocols:							
Kermit	N/A*	❑	❑	❑	❑	■	❑
One form of Xmodem	N/A*	■	■	■	■	■	■
One form of Ymodem	N/A*	❑	❑	❑	❑	■	❑

—Editor's Choice ■—Yes ❑—No

N/A*—Not applicable: PRO Staff does not have graphics and communications modules.

ENDS

the inability to import anything but straight ASCII files, the small number of numeric formats, the inability to sort by row or column, and the lack of graphics. You also can't export spreadsheet data to the word processor.

Tandy Corp. is trying to fix its spreadsheet problems by offering a scaled-down version of *Lotus 1-2-3* that runs in the separately sold *DeskMate* environment. It is due for release in the fourth quarter of this year; however, it will have a retail price of $219.95, more than twice the price of *DeskMate*.

When it comes to tying the applications together, *DeskMate* does some things well and others poorly. If you want to transfer data from the database into a word processing document, you'll have to go one field at a time (or else rekey your data into the address book). This makes cutting-and-pasting useless for data interchange. You can print a record to a file and then merge it into a document, but it comes up with some strange symbols, and fields are offset from labels.

Although *DeskMate* has coarse integration and is short on power, it has some nice features. If what you want to do isn't complex, doesn't require extensive formatting abilities, and is limited in scope, then this program is worth its $99.95 price.

Integrated 7 Advanced

The spreadsheet application is listed first on *Integrated 7 Advanced*'s main menu. This is no accident: Mosaic Software has specialized in spreadsheet and graphics programs, and it shows in the company's integrated products. The spreadsheet here is excellent. Its extensive set of numerical functions can make numbers seem to dance across the cells. And the nine graph types let you portray those numbers in a rich assortment of bars, lines, and pie slices.

The $199 program also has a natural,

Q&A: The Answer for Many

by Catherine D. Miller

Try to guess the name of the quintessential flat-file database, and you'll probably come up with *Q&A*. Yet database functions are only part of the $349 program's charm: the word processor included is so good that maker Symantec introduced an enhanced version of it as a standalone package, *Q&A Write*. This quickly became the de facto standard among low-cost executive word processing packages.

Although features in both of *Q&A*'s applications are plentiful, power and ease-of-use are happily conjoined in a smoothly integrated package.

Q&A 3.0 operates under an attractive DOS shell that supports six other programs on *Q&A*'s main menu, allowing you to use other programs without leaving *Q&A*. Although *Q&A* lacks communications and spreadsheet modules, it provides hooks to send faxes via the Intel Connection CoProcessor board and to include whole or partial spreadsheets from *Lotus 1-2-3*, Release 2.01, in your database and word processing files. You can send faxes in the foreground or in the background while you continue working.

Import and export utilities let you work with data from many programs. *Q&A* supports import of .DIF, ASCII, and fixed-ASCII formats, and export to programs accepting .DIF, ASCII, fixed-ASCII, and .DBF formats. You can also import, rotate, and size Lotus .PIC graphics at print time.

FILE MODULE

The File module is the heart of *Q&A*. Sixteen million records per data file, 1,678 alphanumeric characters per field, 115 fields indexed simultaneously, and forms spanning ten screens and containing 2,182 fields are a few of *Q&A*'s impressive statistics.

You can join data files and sort any field in descending or ascending order. Data field types include character, numeric, currency, keyword, date, hours, and Boolean; financial, statistical, and text/string functions are included in *Q&A*'s programming language.

Another bonus is that you don't need to learn a complicated query language to ask questions about your databases. *Q&A*'s Intelligent Assistant allows you to query your databases in a language you already understand: English. The Intelligent Assistant has a basic vocabulary straight out of the box, but you can teach it words it doesn't know. In fact, you can teach your Intelligent Assistant to look at your database files the way you do.

Although the database portion of *Q&A* is basically flat-file, it does have some relational features. While you are working with a database, external Lookup commands let you retrieve data from secondary databases and include it in the current database.

Reports are created from a Report menu, allowing you to save report formats. You can include information from several databases in a single report, with 50 columns and a maximum report width of 1,000 characters. *Q&A* even allows you to use information in one column to calculate that of another column.

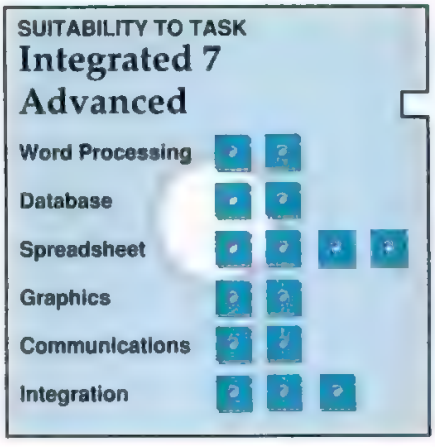
The tight integration of its word processing and database modules makes Symantec's *Q&A* the ideal program for mail-merge. While creating a document, you choose the fields to include in the document from your selected database file.

THE WRITE FEATURES

Q&A's Write module has nearly all the features you'll need to

almost childlike approach to transferring data. With just a couple of keystrokes, you can open a window from one application within another and just pull the data over.

The strengths of *Integrated 7 Advanced*, however, only amplify the disappointing nature of the program's other elements. You have almost no control over the form of a database record, and the word processor is no bargain. Given these weaknesses, it's difficult to understand the product's price tag.



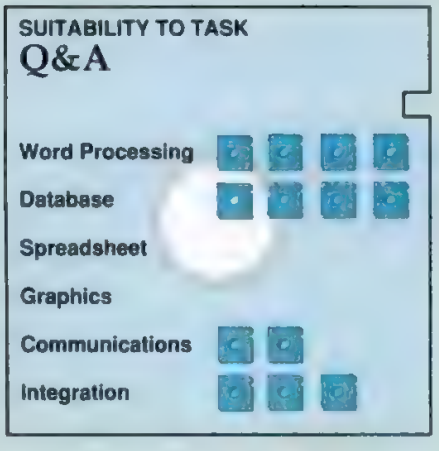
FAMILIAR LOOK

The program's spreadsheet module looks almost exactly like *Lotus 1-2-3*, Version 2. In fact the main menu, also invoked by pressing the slash key, offers exactly the same choices. But Mosaic has improved the screen design a bit by arranging the menu choices in a pop-up box rather than stringing them out across the top of the screen.

The second and even third layers of menus and commands in the spreadsheet are also very close to what you find in *1-2-3*. One of the rare differences is the extra Translate command on the File menu. This is used to convert worksheets in *Integrated 7 Advanced*'s native format—with a .WKU extension—into *1-2-3*'s .WKS or .WK1, .DIF, or TWIN-1 formats.

Although *Integrated 7* has its own format, it will retrieve and read .WKS and

create great-looking documents. Multiline headers and footers, variable line spacing, line drawing to create borders and boxes, a 100,000-word dictionary to spell-check your documents, eight columns per page, powerful search-and-replace functions, a strikeover option, and soft hyphenation are just a few of *Q&A*'s advanced document-creation features. Character enhancements include italic, bold, underlining, superscript, and subscript. What's missing? Multiple windows, indexing, table of contents generation, outlining, and footnotes. You're also limited to working with only one document at a time.



Because an open document is held in memory—up to 80 pages—editing functions are performed quickly. To create professional-looking documents, you can include nine fonts per document, and *Q&A* offers laser printer and PostScript support.

Creating form letters is a simple matter with *Q&A*'s powerful mail-merge capabilities. While you're creating a form letter, Alt-F7 will activate *Q&A*'s mail-merge feature. Choose from a list of databases or type in the name of one. Then position your cursor at the point where you want to include the field data. Your next step is to type in the name of the field or choose the field from a list of those in the database you've selected. As you update the database, the changes are reflected in your merge document.

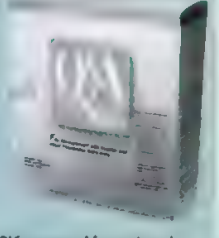
To create mailing labels for letters, simply choose the Mailing Label option from the Write menu. Choose from a list of standard Avery and pin-feed mailing labels, then select a *Q&A* database file from which to extract the mailing label data. Although default fields of first name, last name, address, city, state, and ZIP code are given, you can add, delete, or change the fields to match the database. A keystroke combination gives you a list of fields in the database.

You can create macros from within a Write document, a file, a report spec, or the Intelligent Assistant. You can also create macros that span several program modules. Macros aren't automatically saved to disk, so you must remember to save them.

Q&A's Network Pack ($299) allows three additional users to share a copy of *Q&A* on a network. Five levels of password protection, administrative rights, and record locking ensure data security. DOS and OS/2 (*Q&A OS/2* carries the same list price of $349) users can even share data with no additional setup. In fact, you can assign access rights when using a single copy of *Q&A*.

A well-designed interface, two levels—user-customized and system—of context-sensitive help, and excellent documentation are boons to beginners and experts alike. If you're a resolute *1-2-3* user and are looking to expand to a real database and word processor, or if you're an infrequent spreadsheet user desiring the best database-and-word-processor combination around, *Q&A* can't be beat. ■

FACT FILE



Q&A, Version 3.0
Symantec Corp., 10201 Torre Ave., Cupertino, CA 95014; (408) 253-9600
List Price: $349.
Requires: 512K RAM (640K recommended; 640K required for network use), two disk drives, DOS 2.0 or later
In Short: Combining first-class word processor and flat-file database modules, *Q&A* is ideal for people whose integrated needs lie with these two applications and who prefer to use *Lotus 1-2-3* for their spreadsheet data. Strong links to *1-2-3* let spreadsheet users easily integrate their spreadsheet information into both Write and File modules of *Q&A*.

CIRCLE 402 ON READER SERVICE CARD

Integrated 7 Advanced, from Mosaic Software, lets you transfer data among some of its applications by opening a window, marking data, and then pulling it over. Right, a range of cells from the spreadsheet is about to be merged into a word processing document.

.WK1 files without a moment's hesitation and without dropping any of the formulas.

The differences between this spreadsheet and *1-2-3* show *Integrated 7* to come out ahead. For one thing, the information line explaining menu selections is much clearer in *Integrated 7*'s spreadsheet than in *1-2-3*. *Integrated 7 Advanced* offers two more data ranges for its graphs and five more graph types: pie/bar combination graph, 3-D pie chart, horizontal bar graph, 3-D bar graph, and text chart.

The spreadsheet has many other extras as well. You can protect cells, hide columns or ranges, split the screen horizontally and vertically, and use macros.

DATABASE WOES

Integrated 7 Advanced's database is little more than a spreadsheet in database's clothing. You can't even import data directly—it has to come through the spreadsheet, which is a cumbersome process at best.

Another problem with the database is the lack of control it gives you over the record layout. You name and define fields on a template. The program places those fields flush-left down the screen, with one line of space between every two fields—and that's it. You can't change this layout in any way.

Each record can have up to 40 fields. You specify the length of the field, the data type (character, whole number, real number), and date. You can also indicate whether or not it's an index and whether it's to be protected. You can't refine the field definitions, add comments, or enter titles.

After you've added records, the database functionality gets better. You can select and display records using complex criteria statements. These statements are composed of field names, logical operators such as "less than" or "not equal to," and Boolean AND and OR operators. Selections can be based on criteria for a number of fields at once.

UNDISTINGUISHED WP

The word processor in *Integrated 7 Advanced* is undistinguished. Although you can easily format a document by changing the margins and setting the justification freely, you can't vary the line spacing or page length. In addition, you can't generate superscript or subscript—there's only one system font.

The package's spell checker is about 20 percent smaller than current standards, and the thesaurus is weak as well, offering you only a limited number of synonyms.

One of the nicest features in *Integrated 7 Advanced*, however, is the ease with which you can move data around. Between the word processor and the spreadsheet—and the database and the spreadsheet—you can transfer data by reaching through a window and grabbing it. This is one of the most pragmatic approaches to data transfer of any low-end integrated program. Of course you can also combine whole documents or spreadsheets.

The integration of the database with the word processor isn't quite as good. You can merge fields into a document, but only as you print a document that has the appropriate field names. Almost the same approach is taken to get a graph into a document. You place a graph file name in your document and the graph is printed in that spot, but you can't see it on the screen.

Although the name *Integrated 7 Advanced* is intended to play up the range of applications in this program, only the spreadsheet and graphics applications stand out from the pack. Of the other five, two—datamail and terminal emulation—are hardly independent. And the database, word processor, and communications applications are almost too basic to be touted in a product title. Especially since this is the most costly of all the low-end integrated products reviewed.

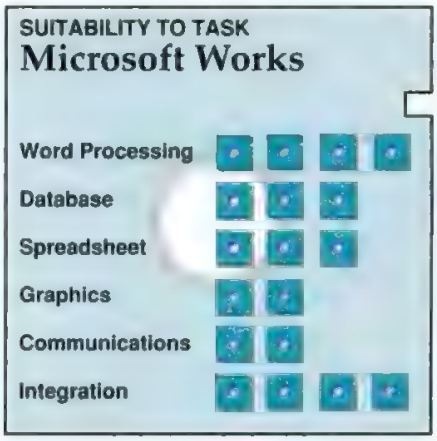
FACT FILE

Integrated 7 Advanced,
Version 2.48
Mosaic Software Inc., 1972 Massachusetts Ave., Cambridge, MA 02140; (617) 491-2434.
List Price: $199.
Requires: 512K RAM, two floppy disk drives or hard disk with 2MB available space, DOS 2.0 or later.
In Short: *Integrated 7 Advanced* has an excellent, *Lotus 1-2-3*–like spreadsheet application. The program's graphics features and windows-oriented integration are exemplary, but the database is restrictive. It won't let you import data directly, ties your hands in design, and has no internal reporting. The word processor is conventional.

CIRCLE **406** ON READER SERVICE CARD

Microsoft Works

Microsoft Works is a sophisticated, extremely well integrated set of applications that includes a particularly good word processor. You can format characters, lines, and paragraphs with great creativity and see the results in near-WYSIWYG preci-



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PC MAGAZINE EDITOR'S CHOICE R&R Relational Report Writer, V2.0 December 8, 1987

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CIRCLE 315 ON READER SERVICE CARD

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CIRCLE 158 ON READER SERVICE CARD

SOFTWARE
LOW-END INTEGRATED

FACT FILE
EDITOR'S CHOICE

***Microsoft Works,* Version 2.0**
Microsoft Corp., 16011 N.E. 36th Way, P.O. Box 97017, Redmond, WA 98073; (206) 882-8080.
List Price: $149; upgrade from Version 1.05, $50
Requires: 512K RAM, DOS 2.0 or later
In Short: *Microsoft Works* is a powerful program with a very contemporary, well-integrated design. The word processor is particularly good; it has a full range of formatting and editing features and a WYSIWYG display. The on-line tutorial is superb, and the faults of the product overall are few.

CIRCLE **407** ON READER SERVICE CARD

sion in *Works*'s word processor. All this is priced at a very accessible $149.

Few programs offer the kind of on-line aid you get in *Works*; you can virtually learn the program without ever looking at the manual. A context-sensitive, comprehensive help window is always reached by pressing F1. Command buttons at the bottom of the window lend even more assistance in the form of discussions on basic skills, a help index, and a series of snappy, thoughtful tutorials.

FULL FUNCTIONALITY

What really makes *Works* impressive is the functionality of its applications. Probably the best place to see this is the word processor, which is chock-full of noteworthy features. You can create footnotes, place bookmarks at various locations in a document, size and reorient charts imported from the spreadsheet, check spelling, and undo previous operations.

> What really makes *Microsoft Works* impressive overall is the functionality of the program's applications. These are best realized in the word processor, which is chock-full of noteworthy features.

You can edit and format text in just about any way you like. Lines and paragraphs can be centered, aligned left or right, or justified. Line spacing can be controlled at the paragraph level and set in fractional numbers of lines or points. You can also vary the left and right paragraph margins by changing the indents.

Other formatting features let you add space before or after a paragraph, keep paragraphs together, set tabs, put borders around text, use a number of type styles, and vary fonts and point sizes.

All formats and text styles are visible on the screen. That means you see the actual line spacing and line alignment, as well as bolds, italics, and strikeover text. But you can't see different fonts until you go to a print preview mode.

Overall, the only major complaint with this module is the limited number of synonyms offered by the thesaurus.

LOOKING AT THE DATABASE

Like the word processor, the database shows type styles on the screen; however, these are displayed only in the single-record (form) view. You can use different fonts for field names or data entry (one font per database), but you won't see them in their true form on the screen, even in print preview mode. Most of the other formatting you'll do in the database is simply a matter of placing fields on a form and setting the alignment.

To create a database in *Works*, you indicate field lengths and allocate the number of lines per field. You don't have to define the contents of fields, but you might choose to. For example, you can specify that numbers be displayed with dollar or percent signs.

After you've entered data, you can display records one at a time or in a table. Unfortunately, *Works* does not carry field-length information over to its table view; unless field lengths are the default ten spaces or less, you'll have to set them again.

In the table view, numeric fields have to be at least one space longer than the data they hold, or numbers will be replaced with pound symbols.

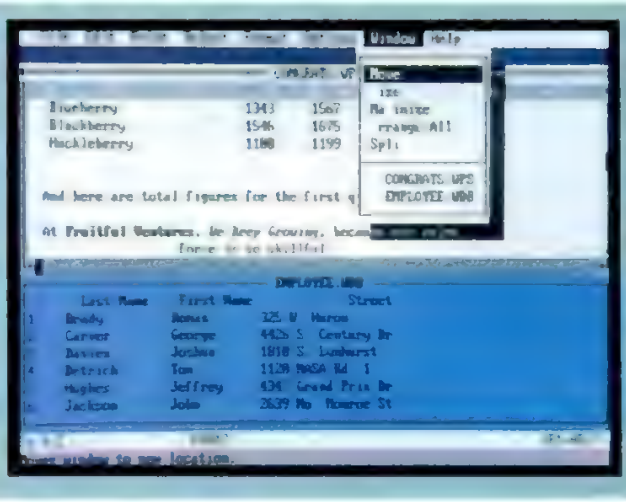
The database has one other quirk: it drops leading zeros in a number, no matter what format you pick. This is particularly problematic—especially if you're trying to enter ZIP codes, where leading zeros are legitimate.

Database searches in *Works* can be multileveled and complex. A Query facility lets you create search formulas using comparison statements and logical operators. Records that don't match a query are hidden from view, which makes this technique a good way to narrow your database before writing a report. You can also hide fields (columns) in the table view.

THE NUMBERS GAME

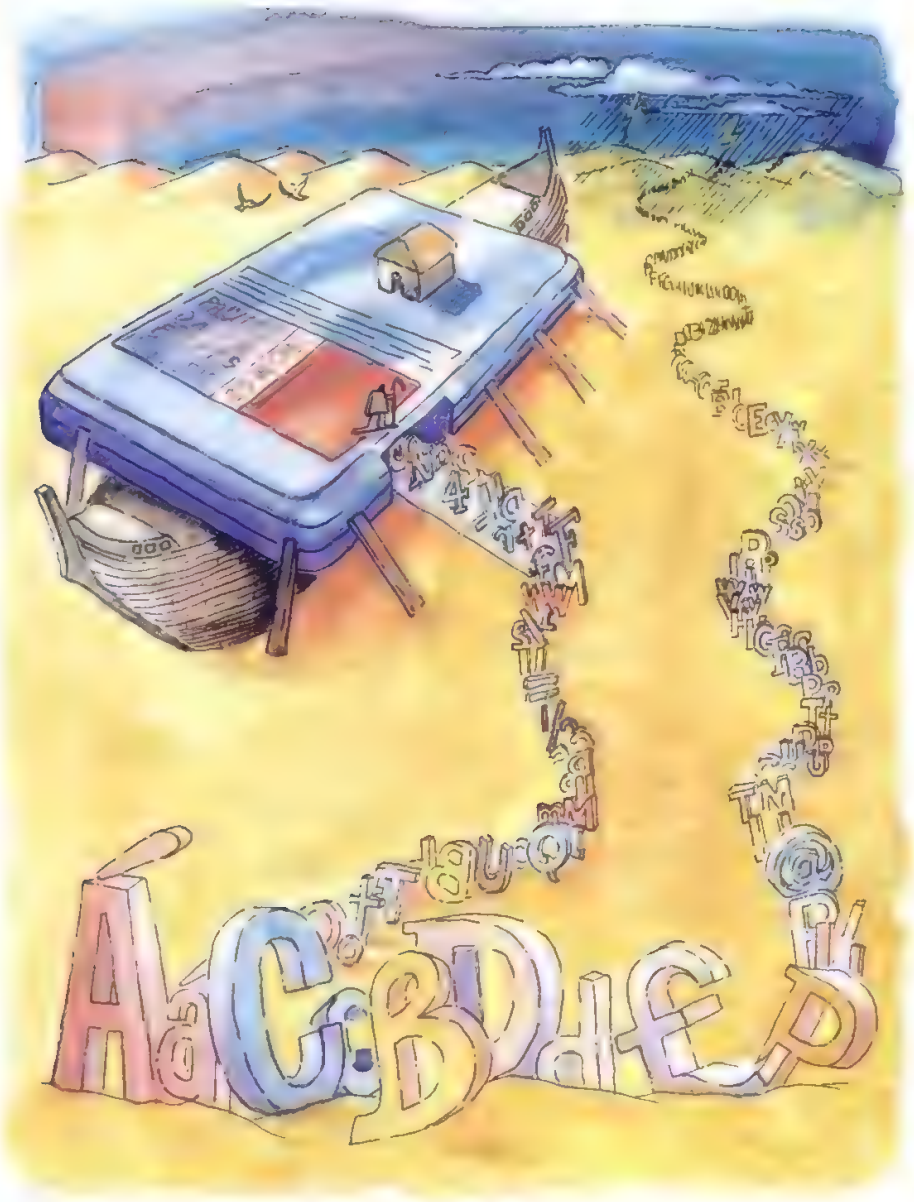
Columns can also be hidden in the spreadsheet application. The purpose is the same: to customize printouts or to remove extraneous material from your view of data on the screen.

Spreadsheet commands to control what you see on-screen are ample. You can sort a worksheet, for example, on up to three



With the option to view up to eight windows on the screen at once in *Microsoft Works*, you can see part of a file from all four major applications, easing data transfer. Here a word processing document is in the active top window, and a database is in the lower window.

PHOTOGRAPHY THOM O'CONNOR



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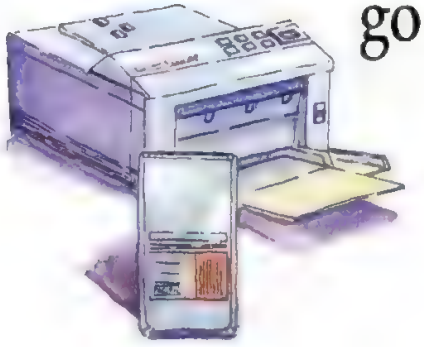

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CIRCLE 332 ON READER SERVICE CARD

columns, move cells and ranges around, change column widths, add rows or columns to create a greater sense of space, and freeze titles.

All of the spreadsheet commands for selecting and formatting cells and ranges are standard—except that for a low-end program, it's unusual to see actual type styles on the screen.

The consistency of the near-WYSIWYG display throughout *Works* is reflective of the general consistency of the package as a whole. Menus and commands are very similar from one application to another. Even more significant than the common command structure is the way in which modules are integrated. Data can be moved in and out of applications simply by cutting-and-pasting.

The consistency of the near-WYSIWYG display throughout Microsoft Works is reflective of the general consistency of the package as a whole.

To quicken the process of data exchange, *Works* lets you have eight files open at once. When you return to a file you've left, you'll find yourself at the point where you exited. When you have more than one file open on-screen at the same time, you'll appreciate the ability to size and move the windows to make viewing easier.

Works is packed with a host of other commendable features—more than we can go into in detail here. Noteworthy are its ability to produce a wide variety of graphs and charts and to run macros, its communications facilities, and the ability to access DOS without quitting. With such numerous and well-integrated features, it's difficult to consider this program as anything but a wise choice.

WORDPERFECT ON THE FLY

by Catherine D. Miller

WordPerfect Executive, $249 from WordPerfect Corp., was created with a specific audience in mind: the laptop-wielding executive on the go. Condensed versions of WordPerfect's word processor (from *WordPerfect* 4.2), spreadsheet (from *PlanPerfect* 3.0), calendar, calculator, note cards, and phone list (from *WordPerfect Library* 1.1) are shipped, and then installed, on one 3.5-inch disk.

The DOS shell encompassing all these programs is a modified version of *WordPerfect Library*'s main menu. A setup menu lets you add your own programs to the main menu, edit or move existing entries, and customize colors and date and time formats. You can exit to DOS to format a floppy disk or perform basic DOS commands like copy, delete, rename, or list files directly from the main menu.

Also included with *Executive* are several macros that automate those chores that business travelers perform routinely—creating travel and expense reports, and itineraries. These macros are compatible with *WordPerfect Library* and *PlanPerfect*, but not with *WordPerfect*. And while the program doesn't have a macro editor, you can use the one included with *Library*. You can also create your own macros in *Executive*.

SOME SACRIFICES

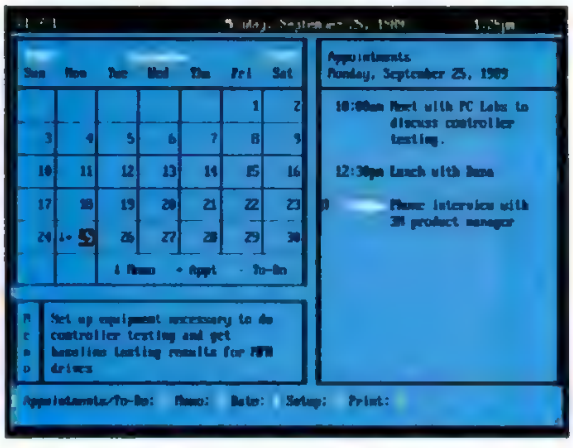
WordPerfect Executive's word processor follows the same command structure as *WordPerfect*, but it sacrifices many of the advanced features. Line drawing, footnotes, table of contents and index generation, math functions, macros, and font support are missing in *Executive*.

Although *Executive* retains header and footer capabilities, they are limited to one line each. Document import/export is restricted to ASCII, the dictionary used to spell-check a document is pared down to 50,000 words, character enhancements are confined to bold and underline, and print functions are limited to the basics.

Documents created with *Executive* are compatible with *WordPerfect*, and vice versa, so the documents you send back to the office can be read into *WordPerfect* and prepared for professional printing. Don't worry about confusing *Executive* with extra formatting codes; when reading documents created in *WordPerfect*, *Executive* ignores the *WordPerfect* codes it doesn't understand.

Executive's spreadsheet manages to retain many of the power features of *PlanPerfect* 3.0. It has a worksheet area of 256 columns by 8,192 rows and retains most of *PlanPerfect*'s functions and formatting capabilities. *Executive*'s spreadsheet can also import and export *Lotus 1-2-3* files. The spreadsheet's two most significant limitations are that it lacks printing enhancements for output and it supports only bar graphs.

In both *Executive*'s word processor and spreadsheet, the choices of features to carry over from their full-fledged counterparts are intelligently made.

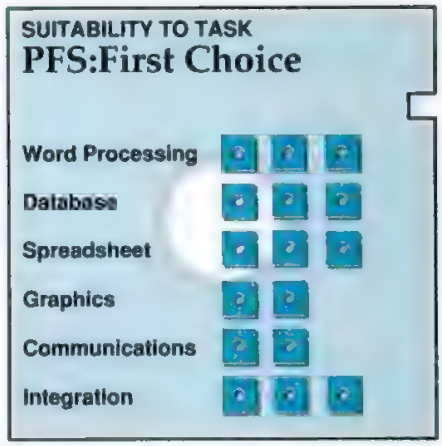


In addition to *WordPerfect Executive*'s familiar modules for word processing and spreadsheet functions, the program offers several PIM features, including an appointment calendar (shown above), calculator, note cards, and phone list.

PFS:First Choice

Software Publishing's *PFS:First Choice*, Version 3.02, is easy to use—its five well-integrated applications provide consistently good features. In addition, *First Choice* is a visual delight. It offers an elegant interface; menu bars across the top of work screens are constant, status information isn't crowded or overdone, and the colors are pleasing.

While the surface design is appealing, the weakness of the $159 package is the lack of any truly outstanding application—one that makes you feel you simply must own the product. For example, the database—the best application in *First Choice*—just doesn't have the power of the top integrated packages, although it offers its share of pleasing features: you can lay out records easily, perform complex multiple-field searches, and handily copy field data, records, or forms.



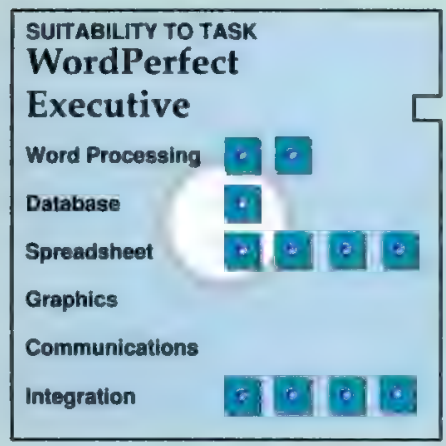
USING THE DATABASE

Retrieving information is the most important use of a database, and *First Choice*'s data retrieval capabilities are robust. Because there are no indexes in this database, you can search on any or all fields at the same time, using range specifications, logical operators, partial matches, and even negative matches.

While the lack of indexes can make searches more freewheeling, there is one potential problem. Indexes are supposed to hasten the search process, so *First*

Considering that *Executive* is designed for laptop usage, for example, the decision to omit *WordPerfect*'s strong output support makes sense.

The appointment calendar includes a monthly calendar, a listing of appointments, and a memo area. You can set an alarm to remind you of important meetings. The default settings for the calendar, including alarm settings, date/time, and color display, can be customized from the appointment calendar setup menu.



Executive's calculator performs addition, subtraction, multiplication, division, percentages, and square roots. You can change the sign of a number, determine the number of decimal places displayed, or specify a floating decimal point. The calculator screen includes a keyboard template, help window, memory register, and display register, which includes a tape to show the calculations you've performed.

NOT QUITE A DATABASE

Although *Executive* doesn't have a database, it has the ability to store certain kinds of information in records. Note cards keep records on individual cards with subject, date, description, and notes fields, allowing you to organize information by subject. The phone directory records include last name, first name, salutation, title, company, address, and notes fields. Lists of the note card and phone directory records on file can be sorted in ascending or descending order by the first field listed. If you desire, you can change the order in which the fields are listed.

You can use the fields in your phone directory and note cards to create mail-merge documents. Because you type the field names into the merge document, you are assured the document has the current field values before you send it to the printer. By marking the records you want to include in the merge, you can eliminate the records you wish to exclude. The merge function allows you to include the current date in your documents as well.

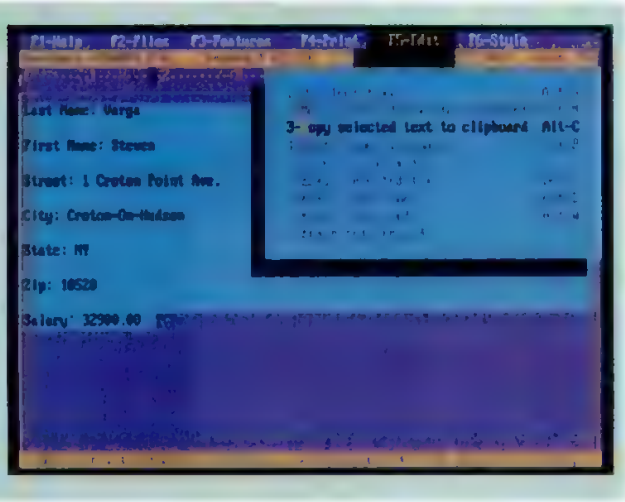
Another function, *Executive*'s clipboard, lets you save or append information from any module, allowing easy transfer of data across modules. An indication of *Executive*'s tight integration is the consistency of its command structure. WordPerfect managed to fit all *Executive*'s function-key commands on one keyboard template. This uniformity makes it easy to move from one module to another. In fact, most of *Executive*'s function-key combinations correspond to those of the standalone programs.

WordPerfect Executive successfully combines a word processor, spreadsheet, and several useful desktop accessories on a 3.5-inch disk. This traveling companion is perfect for businesspeople who use *WordPerfect* or *PlanPerfect* in the office. ■

FACT FILE

***WordPerfect Executive*, Version 1.0**
WordPerfect Corp., 1555 N. Technology Way, Orem, UT 84057; (801) 225-5000.
List Price: $249.
Requires: 512K RAM, one 3.5-inch or two 5.25-inch disk drives, DOS 2.0 or later.
In Short: *WordPerfect Executive* combines essential features from *WordPerfect* 4.2, *PlanPerfect* 3.0, and *WordPerfect Library* 1.1 on one 3.5-inch disk. A perfect integrated solution for laptop users who use *WordPerfect* in the office and have minimal database needs.

CIRCLE 410 ON READER SERVICE CARD



In Software Publishing Corp.'s *PFS:First Choice*, you can easily transfer data between applications by using the clipboard. Here, a database record has been marked so that it can be copied to the clipboard and then pasted into a word processing document.

Choice's speed should suffer. Although I didn't see any evidence of this with a 250-record file using a 33-MHz computer, the program might slow down when you search extremely large databases on a less speedy machine.

Records isolated by a search—and the entire database for that matter—can be viewed one record at a time or in a table format. Table views can be customized by eliminating unwanted fields, reordering the columns, and resetting the column width. Unfortunately for users, resetting the column width is often a necessary evil—the default width is a mere ten character spaces.

Designing the original database form is simply a matter of laying down fields. You don't have to specify field length; when data is entered into the form, fields move to accommodate it. This approach liberates you from figuring out field size ahead of time, but there's a hitch: it can result in sloppy-looking records.

In contrast to field length, field type does have to be specified. You get the customary choices—numeric, date, time—but unfortunately you can't specify numeric fields for currency, percentages, and so on. You also can't have calculated fields unless you use the advanced programming facilities.

Programming lets you control other aspects of data entry as well, with data verification, IF/THEN, and GOTO statements, but it takes patience to learn.

Report writing is an extension of the retrieval process, yet it's given a separate module in *First Choice*. The main problem here is that you're limited to a tabular report format with a maximum of 20 columns. This is restrictive, since databases can have hundreds of fields.

ECONOMY-CLASS MODULES

First Choice's word processor is basic. You get the minimum features you'd expect and even a few extras (like the ability to make the format of a document the default layout), but nothing more. For example, words can be set in bold or italic type styles, but on-screen they'll only be highlighted. A status line tells you what the highlight means.

Document margins, tabs, and indents are set on a ruler line. You can insert as many rulers into a document as you like and hide them to keep the screen uncluttered.

The spreadsheet is more advanced than the word processor. It recognizes almost every *Lotus 1-2-3* keyword and offers a rich assortment of mathematical, trigonometric, financial, and other functions. You can also use logical and string operators. A "quick entry" feature lets you automatically generate a series of cell formulas or row and column headings.

Unfortunately, the spreadsheet has a serious problem—if there is even one moderately complex formula, you'll run out of memory very quickly. How quickly? I couldn't build a spreadsheet with more than 10 columns and 215 rows, because it had a nested IF/THEN formula in one of the columns.

RUNNING THE (SLIDE) SHOW

From within the spreadsheet you can go directly to the graphics application. Thirteen graph types are available, including stacked and overlapping bar charts, a high-low-close graph, and a combined pie and column graph.

First Choice lets you turn your spreadsheet graphs into presentation slides for a computer-run slide show. Pure text slides can be created in the word processor. You can run a slide show manually, or let the computer change the slides at a preset interval of up to 4 minutes and 15 seconds. Graphics and text can also be mixed on a single slide.

On the whole, the integration of applications is first-rate. Pieces of a document, database, or spreadsheet can easily be copied into another document by using the clipboard. Whole files of any variety can be saved to disk and then merged into a document.

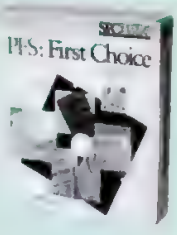
Besides stitching data together, you can easily jump between files by leaving "bookmarks" at the places where you want to return. You can have up to nine bookmarks, which are saved when you exit the program.

In many respects, *First Choice* qualifies as a good choice. It is visually exciting and provides good functionality and near-seamless integration. However, its problematic spreadsheet, combined with the lack of any real oomph in any of its applications, keeps it from the top spot in our hearts.

PRO Staff

PRO Staff is unique at the low end of the integrated software market—the package comes with a three-dimensional spreadsheet. With its 256 rows by 256 columns by 256 pages, you can maintain a very

FACT FILE



***PFS:First Choice*, Version 3.02**
Software Publishing Corp., 1901 Landings Dr., P.O. Box 7210, Mountain View, CA 94039; (415) 962-8910.
List Price: $159.
Requires: 512K RAM (640K RAM for network version), DOS 2.0 or later (DOS 3.1 or later for network version).
In Short: A fine product, *PFS:First Choice* has a snappy screen design with excellent styling and integration. The program is easy to learn, and applications offer solid functionality. But there are no real standout features. The database, with its free-form layouts, is the most interesting.

CIRCLE 408 ON READER SERVICE CARD

PC MAGAZINE
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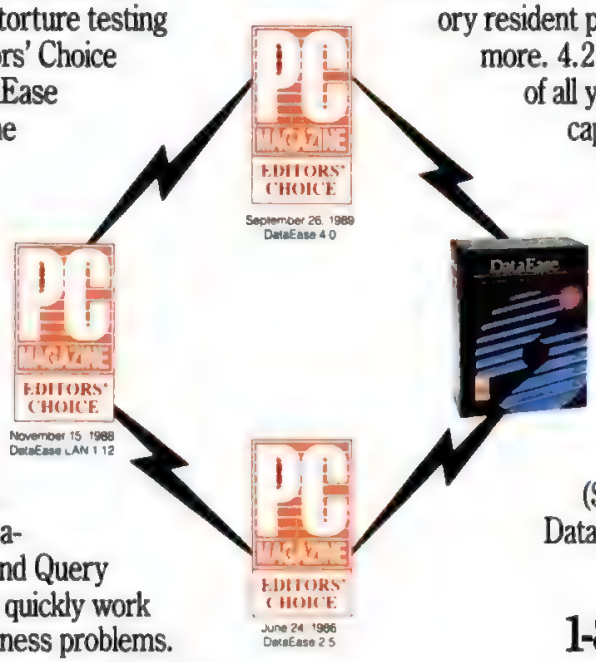

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CIRCLE 227 ON READER SERVICE CARD

large, well-organized worksheet. The *PRO Staff* program also has a flexible database that allows comprehensive field definition.

But *PRO Staff* has some serious problems as well. The $59.85 program was introduced at the end of 1986 and hasn't been updated since that time. Unfortunately, this is immediately obvious. The main menu in the program displays the black background and green type of an old monochrome system, although it also has a red highlight bar and uses a couple of other colors here and there.

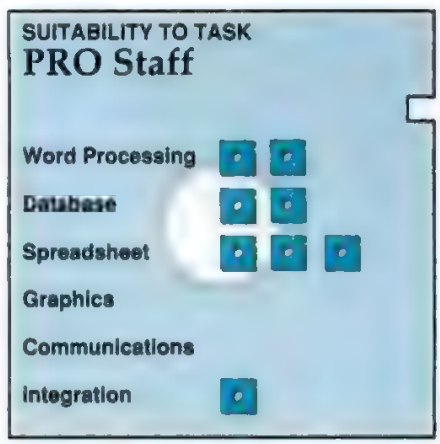
In a number of other ways, too, *PRO Staff* looks and acts like a three-year old product. When you load a file into an application, for example, you have to enter a number rather than a filename. And whenever you save a file, the program requires you to enter the drive letter first.

A partial compensation for *PRO Staff*'s antiquated persona is its rather good price; at $59.85, it's the least expensive of all the low-end products we looked at in this roundup. But before you let the program's low price outweigh its weak design, you should consider the rather mixed nature of the software's functionality and its missing application elements.

PROS AND CONS REVEALED

PRO Staff's spreadsheet reveals the package's good and bad qualities. For one, its worksheet area is the second-largest among the products we tested in our review group. With the spreadsheet module's capacity for over 16 million cells, you'll most likely run out of memory long before you reach the edge. But because the *PRO Staff* program was written before expanded memory was commonplace, the huge worksheet area unfortunately goes mostly to waste.

The best feature of the spreadsheet module is its three-dimensional form. This lets you break each worksheet up into pages. Instead of thousands of cells running out to the right or down, you have what amounts to a smaller group of cells stacked on top of each other, like a pile of worksheets.

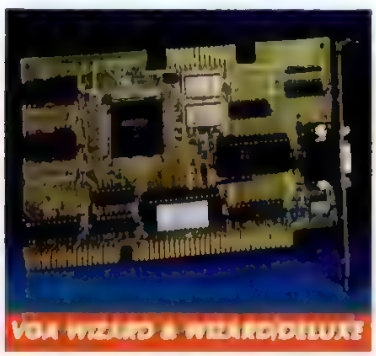


So, for example, you might create a budget worksheet with only one month on a page, making it structurally more like an electronic ledger. Then, just by pressing the PgDn key, you can jump from page to page or month to month.

THE 3-D ADVANTAGE

There are a number of ways to manipulate your view of the worksheet to take advantage of its 3-D nature. You can display rows or columns from each page or split the screen into horizontal and vertical win-

AND THE WINNER IS . . .



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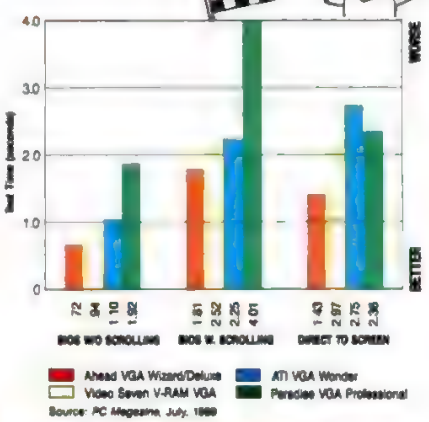

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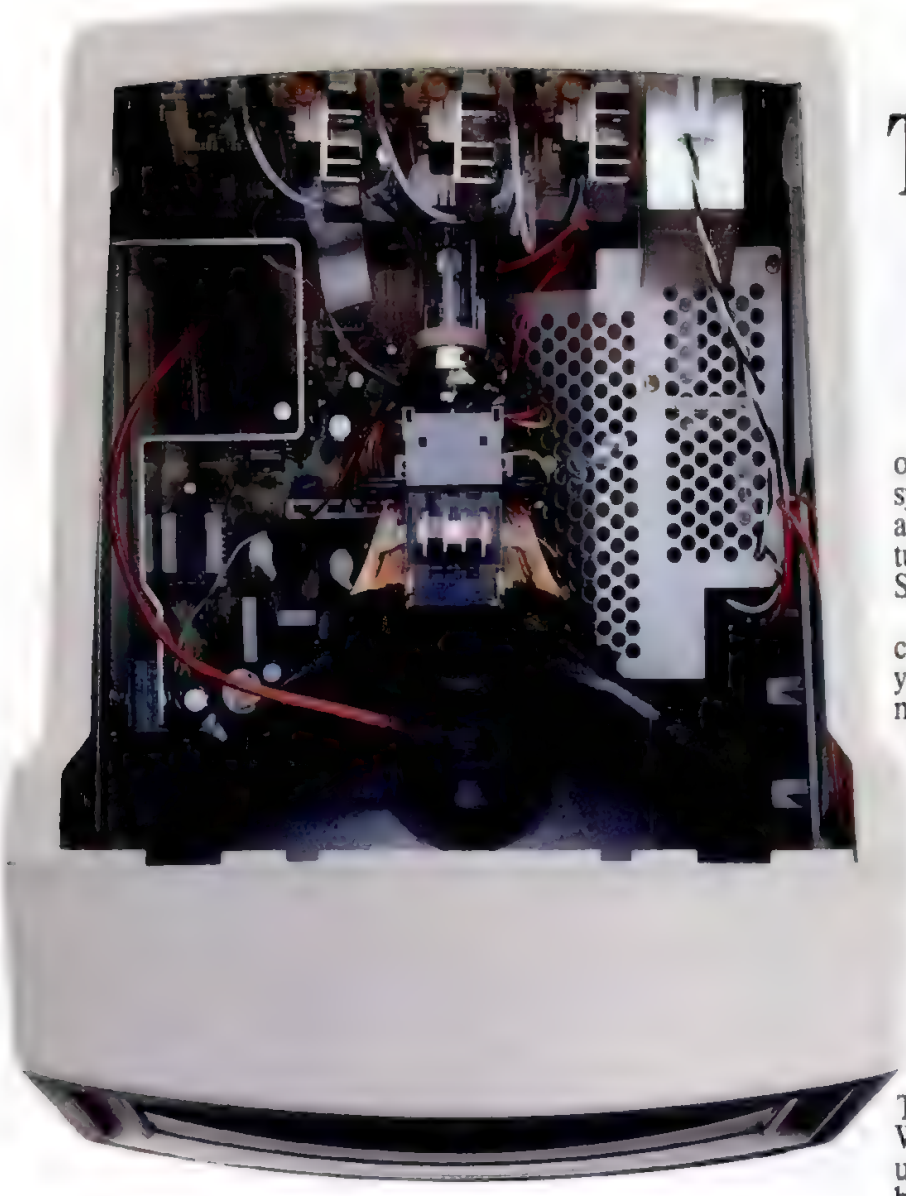

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CIRCLE 490 ON READER SERVICE CARD

PC MAGAZINE EDITORS' CHOICE June 13, 1989

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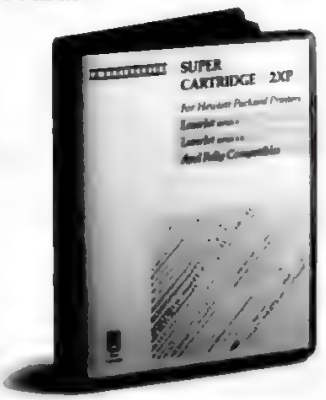

IQ ENGINEERING

CIRCLE 325 ON READER SERVICE CARD

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dows showing different pages.

While the structure of the spreadsheet gives you a lot of creative freedom, other aspects of the application restrict it. You'll find, for instance, that the number of functions you can use in formulas is limited. Missing are the IF, or condition, function, logical functions, some date and time functions, some depreciation functions, and others.

Some other limitations are the inability to import and export files except in ASCII and .DIF formats and the lack of graphics. You can generate horizontal plotted lines of cell values by repeating ASCII characters, but that's the extent of *PRO Staff*'s graphing features.

Just as its spreadsheet does, *PRO Staff*'s database application lets you structure data creatively, too. You can place fields on a record form wherever you like. And there is a rich array of predefined field formats, including those for currency, scientific numbers, Social Security numbers, telephone numbers, dates, and time. There's also a format for single-character conditions, such as Y for yes and N for no.

But the program's database also reflects the same faults as its spreadsheet. It has no import capability at all and can export files only in .DIF format. Also, there are no internal reporting features. In order to create a report, you have to merge records into the word processor.

FLEXIBLE WORD PROCESSOR

The one other application in *PRO Staff* is the word processor. It maintains the program's flexible approach to formatting—you can do just about anything you want. But you can't change fonts or use multiple columns.

Although there is a spelling checker in *PRO Staff*, it's no thriller; it has only 26,000 words in it, so even very common words are missing. For example, when I checked the spelling of our test document, the first misspelled word, *extraordinary*, was not in the dictionary. There is no thesaurus in the word processor. Again, this is probably because the program is so old.

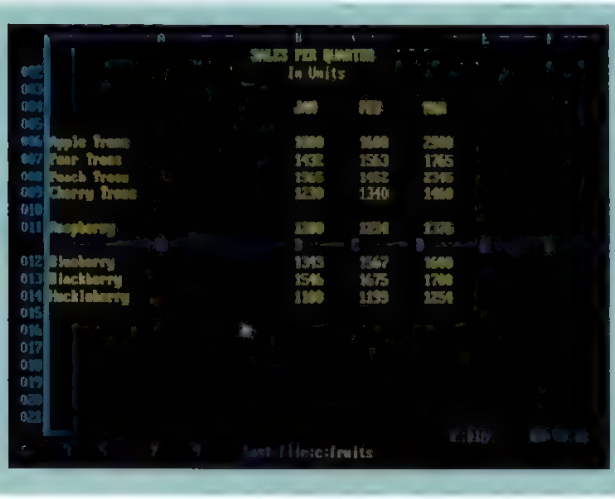
Absent are other prominent elements: communications, graphics, desktop tools, and macros. The three applications *PRO Staff* does offer come packaged separately. This physical separateness reflects an internal separateness. Although you can get data from the database and the spreadsheet into the word processor, the procedure is anything but elegant.

From the spreadsheet you must write an ASCII file and then import it. From the database you have to go through the merge facility, which means creating a special document first with matching field names.

FACT FILE

***PRO Staff*, Version 1.0**
ShareData Inc., 7400 W. Detroit St., Chandler, AZ 85226; (602) 961-7519.
List Price: $59.85 ($19.95 per module).
Requires: 256K RAM, DOS 2.0 or later.
In Short: Offering the only 3-D spreadsheet of all the low-end programs, PRO Staff gives you a huge work area and great organizational flexibility. But the program hasn't been updated in three years and looks it. The database and word processor have limited abilities. There are no graphics, communications, or desktop applications.

CIRCLE 400 ON READER SERVICE CARD



PRO Staff, from ShareData, offers a three-dimensional spreadsheet that eases organization of large amounts of data. You can also split the screen horizontally (as shown here) vertically, or into four quadrants to show different sections of the same spreadsheet alongside each other.

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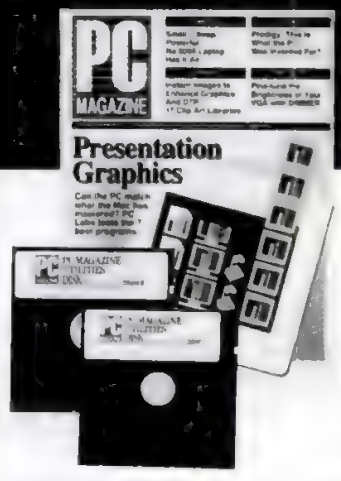

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EDITOR'S CHOICE

- **AlphaWorks**
- **Microsoft Works**

It's true that *PFS:First Choice* enjoys the greatest market share in the low-end integrated software market. But two other programs in our review group clearly stand out from the rest: *AlphaWorks* and *Microsoft Works*. Both programs offer consistently superior functionality. Both boast pull-down menus, shortcut keys, and mouse support. The screens in *Microsoft Works* are more highly stylized and have more contemporary graphic touches; *AlphaWorks* gives you greater control over the use of colors.

The real distinguishing features in these two products, however, are the database and power of *AlphaWorks* and the word processor and on-line help in *Microsoft Works*.

The database structure in *AlphaWorks* is relational rather than flat-file. Thanks to this design, information from different databases can be automatically scooped up and deposited in another database at the time of data entry.

In addition, records can have automatically incrementing fields, 64K memo fields, and user-created pop-up menus. You can even draw lines on the record form to highlight areas or make boxes. Search expressions can be built on a "query-by-example" template.

AlphaWorks has a host of other top-notch features: extensive macro facilities; support of EMS, extended memory, and a math coprocessor; the ability to sort directories and look into a file before loading it; a very large and well-presented dictionary and thesaurus; and the ability to keep 29 files open at the same time.

The word processor in *Microsoft Works* lets you format text in just about any way you can conceive. You can justify text; center it; use strikeover, italic, or bullet characters; and draw lines between sections or box areas—all in full WYSIWYG glory. A preview mode lets you see printer fonts and graphs you've copied and scaled from the spreadsheet.

Other outstanding features in *Microsoft Works* include an admirable system of context-sensitive help, superb on-line tutorial lessons, bookmarks, the ability to hide columns and to sort a worksheet on up to three columns, a wide variety of graphs and charts, and the potential to keep eight windows open on the screen at once.

If your work centers mostly on database applications, you should definitely consider *AlphaWorks*. If word processing is the main focus of your work, then *Microsoft Works* may be the best package for you.

One other program in our group deserves an honorable mention: *Better Working Eight-in-One*. It doesn't compare with our top two picks in depth of features, screen design, or integration. But it has the major applications and offers a host of desktop tools, including a world clock, calendar, phone directory, date book, label-maker, and outliner.

All of the program's functionality is delivered at the extremely low price of $59.95—almost 60 percent less than *Microsoft Works* and 70 percent less than *AlphaWorks*.

There is no way to get data into the database from either the word processor or the spreadsheet.

PRO Staff, overall, is an unusual program. It has fine formatting abilities, a creative spreadsheet structure, and a very good price. But it has stood still as a product frozen in a time when computing was much cruder than it is today. It would be hard to justify buying this program when competing products, at nearly the same price, offer a graphically oriented interface and so much more in the way of tools. ■

Henry Fersko-Weiss, a frequent contributor to PC Magazine, *is a free-lance writer based in Warwick, New York. Catherine D. Miller is a staff writer at* PC Magazine. *Edward L. Perratore is an associate editor of* PC Magazine.

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Mono	$1507	$1732	$1837	$1962	$2457	$2917
VGA/Mono	$1702	$1927	$2032	$2157	$2652	$3112
EGA	$1847	$2072	$2177	$2302	$2797	$3257
VGA/16Bit	$1937	$2162	$2267	$2392	$2887	$3347

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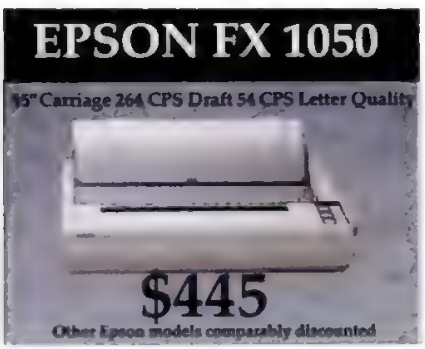

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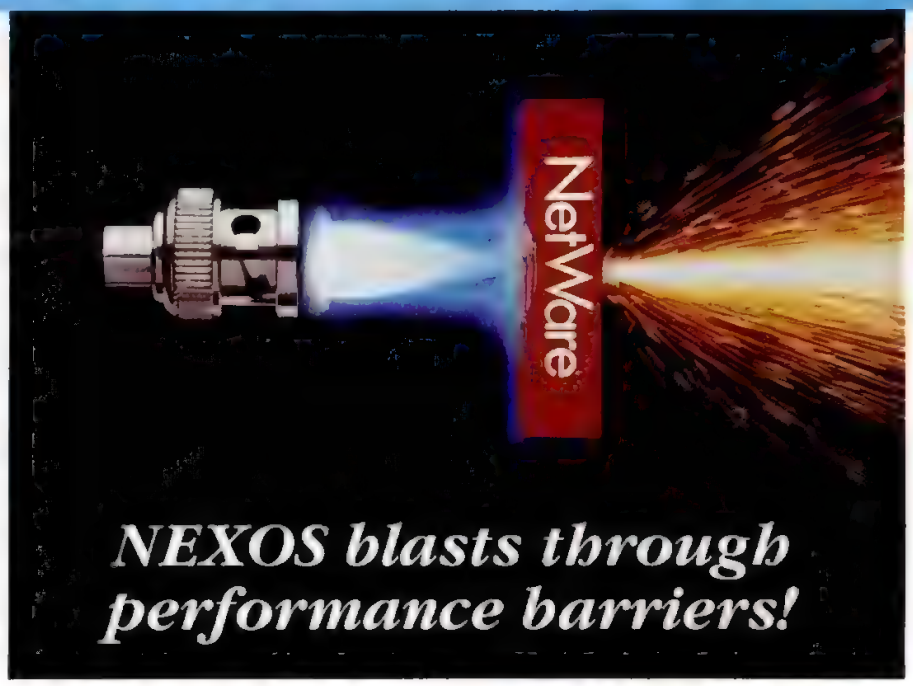

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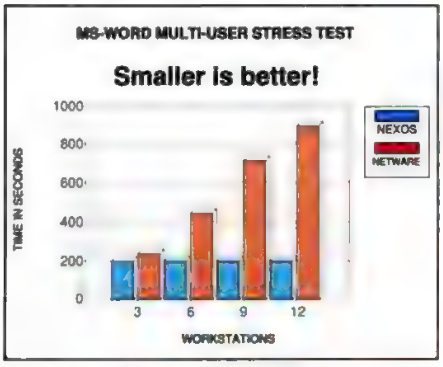

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CIRCLE 243 ON READER SERVICE CARD

DC 2000 Tape Drives Backup on a Personal Scale

by Catherine D. Miller

As the DC 2000 market comes of age, you no longer have to choose among price, capacity, and performance. The 14 units reviewed here offer winning combinations of all three.

The question is not whether you should back up the data on your hard disk, it's one of choosing the backup system that will best serve your needs. Of the many backup systems available for the PC, DC 2000 drives offer a sensible solution for the individual backup of hard disks as large as 120MB.

Peripheral Strategies, a Santa Barbara, California–based market research firm specializing in backup devices, predicts a bright future for DC 2000 minicartridge tape backup systems. While it forecasts that high-capacity helical scan drives—both 8-mm and 4-mm DAT—will show the greatest sales increases over the next few years, Peripheral Strategies expects

that quarter-inch cartridge tape drives with 300MB capacities or less (this includes both DC 2000 and DC 600 units) will continue to enjoy the greatest market share of all backup systems.

Peripheral Strategies expects sales of DC 2000 drives to increase by nearly one-third, from an estimated 419,000 units sold in 1988 to 557,000 in 1989. Sales of DC 600 drives, the current tape backup market leader, are expected to increase at a slower rate, from 645,200 units sold in 1988 to 753,800 units in 1989. By 1990, sales of DC 2000 drives are expected to jump to 710,000 units and should surpass the sales of DC 600 units in 1991.

Why the glowing forecast? When *PC Magazine* last looked at DC 2000 tape drives in our June 23, 1987, issue, we found that the first crop of these systems fell short of their promise. The seven units we reviewed then had capacities of 40MB and less, were priced in the $600 to $1,600 range, were slow, and required 40 minutes to preformat the tapes. We came to the conclusion that DC 600 data cartridge systems, the established quarter-inch tape cartridge technology upon which today's DC 2000 technology is based, offered more performance for the money invested, and that floppy disk backup was sufficient for those who are on a budget.

By 1990, sales of DC 2000 drives are expected to jump and should surpass the sales of DC 600 units in 1991.

The last two years have seen a lot of improvement in minicartridge technology. Capacities have increased, speed has improved, and prices have gone down. DC 2000 backup systems now offer a lot of performance for the price.

THE MECHANISM

The DC 2000 minicartridge itself is based on the same patented design as the DC 600 data cartridge from which it's derived. Standard DC 600 data cartridges pack 600 feet of tape into a 0.6-by-6.0-by-4.0-inch case, but the 0.6-by-3.3-by-2.4-inch standard DC 2000 minicartridges have a tape length of 205 feet. The recording mechanism is similar for the two types of drives, but DC 600 drives rely on separate read/write heads, while DC 2000 drives have one read/write head.

The tape drive's motor is responsible for turning the tape cartridge's drive belt, which in turn pulls the magnetic surface of the tape across the tape drive's read/write head. Data is recorded to tape as the surface of the tape moves across the read/write head, which sensitizes its magnetic coating.

Minicartridge drives can rely on direct drive or belt-driven motors. Direct-drive motors are simpler but have more moving parts. Belt-driven motors may run more smoothly and put various drive parts in better position for interfacing with the tape itself, but they have a greater potential to slip, break, stretch, or vary speed than direct drive motors.

The real secret of the hardware's success and durability, however, is its read/write head technology. Since the read/write head is the only part of the drive that makes direct contact with the recording media, its construction is important in de-

MINICARTRIDGE TECHNOLOGY: Meeting the Capacity Challenge

by Catherine D. Miller

As the minicartridge market has matured, tape capacity is approaching what used to be the domain of the larger, DC 600 data cartridges. While DC 2000 tapes are typically used to store about 40MB of data in QIC-40 or Irwin 40 formats, new versions of the minicartridge tapes designed to store 165MB in QIC-standard formats are currently available.

Standard DC 2000 tapes are 205 feet long. The magnetic portion of the tape, made of a ferric oxide, is combined with a chemical binder that attaches it to a sturdy plastic base film. The formulation of the ferric oxide and the binder can be modified to increase the flux transitions per inch (ftpi) a drive is able to record. The greater the ftpi, the greater the density (and amount) of data that can be recorded on a given length of tape. DC 2000 tape's maximum recording density is 12,500 ftpi.

Tape manufacturers have increased the capacity of minicartridges in two ways. The first increase came with 3M's introduction of the DC 2080 in January 1989. By increasing the maximum recording density of the DC 2000 from 12,500 ftpi to 15,000 ftpi, approximately twice as much data can be stored on these cartridges. QIC-80 and Irwin 80 recording formats require the density of the DC 2080. 3M has also introduced another high-density tape, the DC 2110 (with a recording density of 20,000 ftpi) that is used for recording in the QIC-128 format.

A second way to boost the capacity of tape is to extend the length of the tape by 50 percent, from 205 feet to 307.5 feet, achieving a 50 percent increase in data capacity. To fit 307.5 feet in the same package designed for 205 feet of tape, extended-length tapes have a .025-inch plastic base film, thinner than that of standard-length tapes, .040 inch. Thinner tape wears the drive's head at a different angle than thicker standard-length tapes. As a result, if you consistently use extended-length tapes in a drive, you may have trouble reading a standard-length tape in that drive. Of course, the way a head wears also depends on its design and the material from which it's made.

Extended-length tapes are available in each of the three recording densities described above. An extended-length version of the DC 2000, called the Series II Gold DC 2000XL, is available from Carlisle Memory Products (10170 Sorrento Valley Rd., San Diego, CA 92121-1604; (619) 452-7840). The DC 2000XL carries a list price of $34.75. 3M offers extended-length versions of the DC 2080 and the DC 2110, called the DC 2120 and the DC 2165.

While the capacity of minicartridge products has drastically increased this year, increasing data storage requirements for PCs next year and beyond will spark production of still higher capacity minicartridges. ■

termining the drive's ability to read tapes after many passes. Read/write heads, which can be made of hard or soft brass, ferrite, and ceramics, have become more durable over the years.

3M patented the data cartridge technology it created in 1971 and currently has three licensees: Carlisle Memory Products, Sony Corp., and Hewlett-Packard; HP does not sell data cartridges in the retail market.

To ensure compatibility, the magnetics of these cartridges are similar, although other characteristics are not. Hub design, the drive roller, drive belt, and the corner rollers are important factors in aligning the read/write head with the tape surface, and these vary among tape manufacturers. Sony and 3M offer two-year warranties for their tapes, while Carlisle is so confident of the durability of its tapes that it sells them with a lifetime warranty.

INCREASED CAPACITY

Several factors have contributed to the increased capacities of DC 2000 systems. The capacities of the tapes themselves have increased. Extended-length tapes have increased the length of the tape from 205 feet to 307.5 feet, and tapes with increased recording densities allow more data to be recorded on the same length of tape. (See the sidebar "Minicartridge Technology: Meeting the Capacity Challenge.") Standard DC 2000 tapes typically have a formatted data capacity of about 40MB; extended-length tapes, which are half as long, have a formatted capacity of about 60MB.

The firmware and software of the tape drives must directly support the extended-length tapes, and tape drives that record at greater densities require high-density tape. In the reviews that follow, we let you know which drives support extended-length tapes and the type of minicartridge required for the density at which each drive records.

Another method of increasing the capacity of minicartridge systems is to include software-based data-compression algorithms. The only drive we reviewed that makes use of data compression is Tallgrass Technologies' TG-1140, which is designed and manufactured by Colorado Memory Systems. We also looked at an early production model of a Core drive that uses data compression to pack 240MB on one minicartridge. (See the sidebar "Core Tackles the Low End.") Data compression is a technology that several other manufacturers are considering for inclusion in future versions of their drives.

Because the algorithm is software based, microprocessor speed is important in determining whether using data compression will improve or decrease backup performance. According to Colorado Memory Systems, drives incorporated into 386 systems of 20 MHz and faster have speedier backup times with data compression enabled than with it disabled. The company is currently working on a drive with the data compression capability built into the hardware itself.

With such rapid evolution, obviously some industry standards were needed to better guide manufacturers.

TAPE DRIVE STANDARDS

With such rapid evolution in tape drive technology, obviously some industry standards were needed to better guide manufacturers. The solution lies with the Quarter-Inch Compatibility (QIC) committee, composed of tape drive manufacturers and tape cartridge manufacturers, which was formed to develop standard formats for both DC 600 and DC 2000 data cartridge tape drives.

The QIC-40 standard, one of the first developed for the minicartridge, was developed specifically with the PC market in mind. The QIC-40 standard indicates the file format on tape, theoretically allowing the QIC-40 standard tapes to be interchanged among different drives. A Reed Solomon error-correction algorithm is also part of the QIC-40 standard. Boasting an error rate of 1 in 10^14, this protocol is commonly used with other recording formats as well. Other QIC format standards typically used in the minicartridge market include QIC-80 and QIC-128.

Seven of the 14 drives we reviewed use the QIC-40 format standard; three use other QIC-standard formats. One uses the QIC-24, a format standard common for DC 600 drives.

Two dissenters are the drives from Irwin, which use Irwin's own proprietary format. Irwin was the company responsible for pioneering DC 2000 minicartridge technology and currently has more DC 2000 drives installed in the workplace than any other minicartridge manufacturer. Although you can't exchange tapes written in Irwin format with drives other than Irwin's, there are a lot of Irwin drives out there. This allows the company to maintain a de facto second standard.

In most cases it isn't necessary to spend the time preformatting minicartridge tapes before using them, even though most DC 2000 drives require preformatted tapes. 3M now sells preformatted tapes for the most-popular DC2000 formats, including QIC-40, QIC-100, QIC-128, Irwin 40MB and Irwin 80MB. Tapes preformatted for QIC-80 are expected to be introduced during the first quarter of 1990. Most drives have no problem using these preformatted tapes, which are priced $5 to $8 higher than their unformatted counterparts.

IMPROVED PERFORMANCE

Two units, Sysgen's Reliant Model 510 and Mountain Computer's FileSafe 8000 Plus, avoid the issue of preformatting by formatting the tape while backing up data from your disk—a feature commonly associated with DC 600 data cartridge systems. Both systems rely on controllers, as do DC 600 units, and both write data to tape in proprietary formats.

While backup speed was not adversely affected in the case of the Reliant, the FileSafe 8000 Plus achieved a significant increase in backup performance as a result of running off its own controller. (The FileSafe 8000 Plus can also run off the floppy controller, but it loses much of its performance edge.)

Another unit reviewed in this group, Advanced Digital Information Corp.'s Data 128, relies on its own controller but requires that tapes be formatted before they are used for backup. Like the FileSafe 8000 Plus, the Data 128 showed a significant increase in backup speed over the floppy-disk-drive-controller interface competition. An 8-bit expansion slot is required for these controllers, and they add to the cost of the backup unit—these three units are the most expensive of all the units reviewed. The overall performance increase may be worth it for many users.

While the Reliant, the FileSafe 8000 Plus, and the Data 128 are the only units in this roundup that run off their own controllers, the Irwin Product Group plans to introduce a 120MB drive that relies on its own controller by the time this issue hits the newsstands.

The other 11 drives we reviewed run off your computer's floppy-disk-drive-controller. Although the floppy controller interface limits the data transfer rate, there are still advantages to using this standard interface. A separate controller isn't necessary, and it's a simple matter to connect the PC's power and data-control cables to the drive. This cuts costs and alleviates the need for an expansion slot.

Many of the DC 2000 drives reviewed here are available in both internal and external models. Internal models are $100 to $200 cheaper than their external counterparts but require either a 3.5- or 5.25-inch half-height drive bay. They rely on your computer's power supply and don't take up space on your desk.

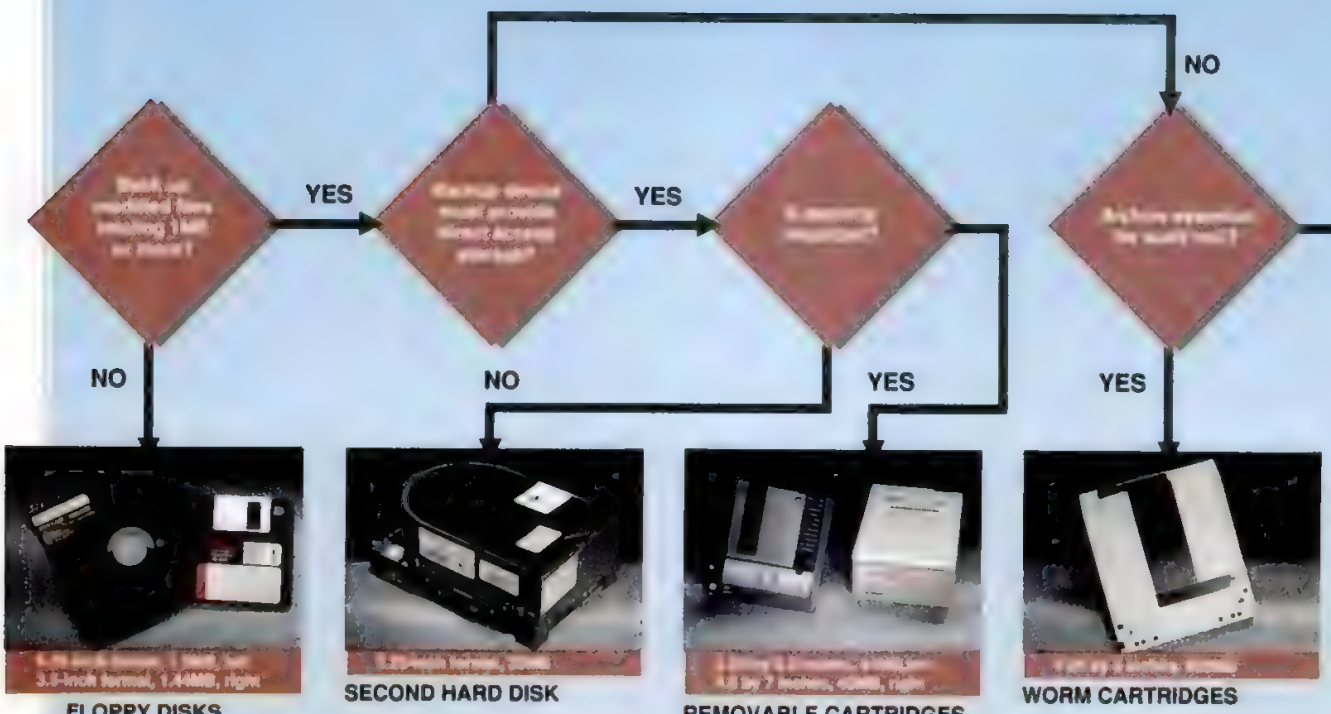
External models are more expensive for two main reasons: They require an adapter card, which occupies an 8-bit expansion slot, and they are housed in soundproof casing designed to protect the drive from the elements. Some include their own power supplies, which further increases the costs. If you purchase adapter cards for several machines, you can easily shuttle the drives back and forth from one computer to another.

STRENGTH IN SOFTWARE

But the hardware is only part of the story; it's the software that really makes a difference in flexibility and the backup and restore features offered. It's the part of the system that you use to communicate with the drive to tell it which data you want to back up and restore.

With the exception of Tecmar, the manufacturers of all the drives reviewed here claim their drives will function only with their software; Tecmar will also supply Sytron's *SY-TOS* software at your request. Sytron (Tel: (508) 898-0100) claims the new version of its software, *Sytos Plus*,

A BACKUP DECISION GUIDE



FLOPPY DISKS

Capacity: 360K to 1.44MB
Hardware investment: none
Media cost per MB: $1
Advantages: no hardware purchase, file interchange, can back up file as it's modified or created
Disadvantages: limited capacity, attended backup only, slow data transfer rate

SECOND HARD DISK

Capacity: 20MB to 1,050MB
Manufacturers: Miniscribe, Core, CDC, Micropolis, Maxtor
Media cost per MB (includes hardware investment): $3.50 to $14
Advantages: speedy random access, can back up file as it's modified or created
Disadvantages: expensive, lack of data security

REMOVABLE CARTRIDGES AND HARD DISKS

Capacity: 12MB to 44MB
Manufacturers: Bernoulli, Tandon, Plus
Hardware investment: $95 to $1,800
Media cost per MB: $2.85 to $39.25
Advantages: speedy random access, data security, can back up file as it's modified and created
Disadvantages: expensive hardware and media, limited capacity

WORM CARTRIDGES

Capacity: 600MB to 1GB (5.25-inch media)
Manufacturers: Mitsubishi, Micro Design International, Information Storage
Hardware investment: $3,400 to $6,300
Media cost per MB: $.32
Advantages: high capacity, data security, data integrity, speedy data access, durable media
Disadvantages: expensive hardware, can use media only once

will support any QIC-40 or QIC-80 drive reviewed here.

Two types of backup have traditionally been available: image and file-by-file. Image backups simply copy a disk, bit by bit, to the tape. Image backups do not preserve file structure and thus do not conform to the QIC-40 standard. File-by-file backups add structure to the data being backed up, actually defragmenting files as they are taken from disk to tape.

It used to be that image backups were much quicker than file-by-file backups, since they simply copied the entire structure of the disk to tape. But improvements in performance—to the point that the floppy-disk-drive-controller interface is often the limiting factor in terms of speed—eliminate that advantage of image backup. That only 6 of the 14 units we reviewed perform image backups is indicative of the trend toward faster file-by-file backup.

The software included with these units is usually packed with features, but some are more pleasant than others. All but the Sysgen Bridge-Tape offer batch-mode operation, and all will append a file-by-file backup. Backup flexibility extends to selecting individual files, directories, and subdirectories (in every case except for the Tallgrass unit). All of the units that we covered here, except for the two from Sysgen, offer password protection for added security and all but the Data 128 allow you to add a volume label on the tape.

The restore options are just as important. What if you actually need to get the data back off the tape and are unable to access it? You need the same richness in restoring options as you do with backup. All the drives reviewed, with the exception of those from Tallgrass and Tecmar, let you restore your files to any directory on any drive.

Of course, a backup plan is beneficial only if it is used. All these units offer varying implementations of automatic backup procedures, allowing you to specify the files to back up and the date and time to do it. All you have to do is remember to leave your system on and a tape set up in the drive. That way you're covered.

Different backup needs require you to select from a variety of backup systems. This guide will help you determine the type of system best suited for you.

Most backup alternatives allow you to choose among external, internal, and portable backup devices. External models require an adapter card and are more expensive than their internal counterparts. In addition, many external models offer their own power supplies to avoid drawing power from your PC. Not all internal backup devices are available in a 3.5-inch form factor.

The manufacturers listed for each type of technology are given as examples and are by no means the only or the best alternatives for that product category. Instead of calculating the cost per megabyte for the hardware, the initial investment and the cost of the media per MB of storage have been separated where possible.

HALF-INCH TAPE: 9-TRACK OR 3480 CARTRIDGES

Capacity: 60MB to 400MB
Manufacturers: LMSI, Storage Technologies, Fujitsu
Hardware investment: $3,500 to $20,000
Media cost per MB: $.03
Advantages: interchangeable, inexpensive media, data security
Disadvantages: expensive hardware, cumbersome for PC systems

8-mm HELICAL SCAN AND 4-mm DAT CARTRIDGES

Capacity: 1GB to 2.2GB
Manufacturers: GigaTrend, NTM Systems, Emerald Systems, Mountain
Hardware investment: $4,450 to $7,300
Media cost per MB: $.03 to .50
Advantages: high capacity, network features
Disadvantages: expensive hardware, slow data transfer rates

QUARTER-INCH TAPE: DC 600 DATA CARTRIDGES

Capacity: 60MB to 525MB
Manufacturers: Archive, Irwin (Cipher), Wangtek
Hardware investment: $1,000 to $2,100
Media cost per MB: $.14
Advantages: fast data transfer rate
Disadvantages: require controller board

QUARTER-INCH TAPE: DC 2000 MINICARTRIDGES

Capacity: 20MB to 150MB
Hardware investment: $450 to $2,100
Media cost per MB: $.20
Advantages: inexpensive hardware, 3.5-inch form factor
Disadvantages: slow data transfer rate, often require preformatting

HOW WE TESTED

In the case of drives that have both internal and external versions available, we decided to test the internal version, which often eliminated the need for adapter boards. We then backed up 43MB of data from a 60MB hard disk, an amount of data that typically required the spanning of two cartridges.

Because the total time it takes to back up a drive includes the time you have to wait for the drive to initialize and to find the tape volume, we chose to measure the time elapsed from the time we typed the last keystroke to the time the program returned control to us. This is a more accurate measurement of backup time than the data transfer rate alone. We backed up the disk in a file-by-file mode and in image mode with the few drives that support it. We then restored the entire backup to the hard disk.

When we first began testing, we had trouble restoring files with several drives. Although initially discouraging, it was discovered that the problem was not with the drives themselves but with the hard/floppy disk drive controller included in our test unit. (See the sidebar "Incompatibility at Large: The Adaptec Affair.")

In order to be included for review, the minicartridge drives had to be received by August 31 and have initial capacities between 40MB and 80MB. Companies that were unable to meet our deadlines include Bi Tech Enterprises, Dolphin Systems, Franklin Telecommunications, PSI Technologies, Tense Lectronix Corp., and Tussey. We chose not to review CMS Enhancements' and Procomm Technology's drives, which have the same hardware and software as the Alloy Retriever/60, reviewed here. And Colorado Memory Systems of Loveland, Colorado, (303) 669-8000, which designs and manufactures the Tallgrass TG-1140, markets the same

INCOMPATIBILITY AT LARGE: The Adaptec Affair

by M. David Stone

Getting a tape drive to work is not always as simple as putting it in your system and properly installing the software. In some cases, you have to worry about your disk controller card.

During the course of this review, several of the drives tested refused to work reliably. In the most ominous case, the backup appeared to go swimmingly. However, the system refused to cooperate when it came time to restore the files, tending toward random fatal errors during the procedure.

The cause of the problem turned out to be our Adaptec ACB-2372B disk controller card, which simply doesn't support the configuration we were using for the tape drives in question. The configuration involved hooking up each drive by way of an adapter board that connects to the disk controller. The B version of the board (which we were using) has certain design constraints that grow out of its use of the Intel 82072 data separator chip.

According to Patrick Pejack, applications engineer for AT products at Adaptec, the time it takes the Intel chip to perform certain functions created a potential time-out problem for OS/2, Version 1. Adaptec had to build a board that would work with a tape drive at a third floppy address (that is, in the same system with a B: drive) or one that would work with OS/2. Adaptec chose to make the board OS/2-compatible.

Byron Smythe, product manager for the Adaptec controller, points out that the B version of the board will work with a drive hooked directly to the floppy disk connector, as if it were a B: drive. This statement was confirmed by PC Labs' experience. (Smythe says the board specifically supports the Alloy, Archive, Everex, Irwin, Mountain, and Tallgrass internal tape drives.)

Smythe and Pejack stress that the inability of a tape drive to coexist with a B: drive is limited to the B version of the Adaptec board. The C version of the board, which replaces the Intel 82072 with a National Semiconductor chip, fixes the problem. When we replaced the B boards in our test systems with C boards, our problems disappeared.

Betting in favor of solidified standards? Just try mixing and matching a tape drive with your existing controller—without first doing some hard checking.

If you are planning to buy a tape backup system and you have the Adaptec ACB-2372 in your PC, you should first find out which version you own. Look on the top left of the component side of the board for the model number. If it says ACB-2372, you have the B version and cannot expect a tape drive to work in the same system with a B: drive. If it says ACB-2370/72C, you have the C version and should run into no special problems.

You can also identify the version by the presence of either an Intel 82072 chip (look for the Intel name) or a National Semiconductor DP8473 chip (look for the company logo, in the form of two squiggly lines.) Unfortunately, there is no simple way to upgrade a board with the Intel chip. If you must have both a drive B: and a tape backup unit, your only real option is to get a new controller.

OTHER POTENTIAL ISSUES

Even if you don't have an Adaptec card, you may still run into compatibility problems—especially if you have an inexpensive floppy disk controller that's built around the cheapest possible data separator chip. Data separator chips can be designed as analog or digital devices; usually, an analog design is more expensive, since it can tolerate wider speed variation—wow and flutter to stereo buffs.

According to Bill Kenney at Alloy Computer Products, a typical disk controller with an analog data separator chip can handle a speed variance of about ±12.5 percent, for a total win-

drive under the name of Jumbo 120 for $399, nearly $100 less than the Tallgrass unit.

The 14 minicartridge DC 2000 tape drives we review here come from Advanced Digital Information Corp. (ADIC), Alloy Computer Products, Archive Corp., Everex Systems, Irwin, Mountain Computer, Palindrome Corp., Sysgen, Tallgrass Technologies Corp., and Tecmar. Capacities start at 40MB and 80MB, ranging up to 151MB on a single minicartridge. If your backup requirements don't fit into this area, our Backup Decision Guide is a good starting point in choosing an appropriate backup system.

dow of 25 percent. In this category are the original IBM PC controller and the Western Digital controller found in most AT clones. A typical controller based on a digital data separator chip provides only a 2 percent to 3 percent window. While the difference does not cause problems with today's floppy disks, which have a typical speed variation of about 1 percent, tape drives are another matter.

The QIC-40 specification allows a maximum speed variation of ±9.1 percent, for a window of more than 18 percent. Clearly, this is not a problem for a board with 25 percent tolerance. Just as clearly, it is a serious problem for a board with only 2 to 3 percent tolerance. And the problem is real enough that Alloy, according to Bill Kenney, "won't guarantee that any board with a digital data separator will work with our tape drives." (Even so, Kenney points out that at least one board based on a digital data separator—the Western Digital "FOX"—has a tolerance that approaches 25 percent.)

Even if you've taken the precaution of checking your controller to ensure that it is capable of working with the tape backup unit you plan to buy, don't take any chances. Once you get the tape drive installed, run it through one full backup and restore (but make sure the files have been backed up by some other means first). If your disk controller has any problem with the tape drive, you'll want to know immediately—not when you're desperately trying to restore data you really need. ■

ADVANCED DIGITAL INFORMATION CORP.

Data 128

by Winn L. Rosch

More speed means avoiding the big slowdown—the floppy disk controller used by most minicartridge systems. Advanced Digital Information Corp. takes the fast track by exploiting the SCSI interface; it links its external Data 128 tape drive to your computer through a SCSI adapter. The result is an expensive ($2,295) 128MB minicartridge tape system that is about 50 percent faster than its floppy-interfaced cousins.

ADIC ranks among the old line of PC tape backup makers. Founded in 1983 by a consultant to the 3M company, it claims to have been the first to apply 3M's data cartridges to PC and Novell backup systems. The new Data 128 is an expanded, renamed version of an earlier product, the ADIC Model 480. In fact, the review machine actually wore this label. With DC 2110 tapes, the Data 128 packs 86MB per cartridge using 32 data tracks. Using 3M's brand new and substantially longer DC 2165 tapes, it stretches its single-cartridge capacity to 128MB. The drive follows the new QIC-128 standard, a refinement of the QIC-100 standard. ADIC also markets the Data 60, which has a 40MB capacity with DC 2000 tapes and 60MB capacity with the longer DC 2120 tapes.

ISA COMPATIBILITY

The SCSI host-adapter expansion board is a short card that uses the 8-bit PC bus for compatibility with all Industry Standard Architecture computers. The Data 128 drive itself measures only 3 by 6.5 by 11 inches (HWD); the tiny box links to its host adapter through a 45-inch long, moderately flexible cable.

Inside the two-piece aluminum box is a 3M company tape drive relying on a direct-drive motor, mated with an auxiliary SCSI interface board. At the rear of the case is a small dual-input-voltage (115/230 VAC) power supply, that draws its power directly from any wall outlet. A tiny 2.5-inch fan on the left cools the drive. A rotary switch accessible through a hole in the bottom panel allows you to select the SCSI device number of the tape drive.

In addition to the fast SCSI interface, the Data 128 earns its backup speed with faster tape travel, churning its magnetic ribbon at 90 inches per second during read and write operations. Given an unlimited supply of data, it can achieve a raw data rate of nearly 6MB per minute. However, system and software overhead constrain that performance, and the drive shuttled tape almost in start-stop mode when backing up the 16-MHz 80386 test machine. The result is that its actual transfer rate tested at just over 3MB per minute—still a respectable speed for a minicartridge.

The *Data* software that controls the system is compatible with DOS and Novell operating systems. Although it has only a single-minded file-by-file mode, it offers both a tightly guided menu system and, through a subsidiary program, batch operation. While it can automatically start backups at an appointed time, the *Data* program takes over your computer while it awaits its appointment with destiny.

BRAIN-FREE USE

The system is designed for brain-free use. You're first guided by a preliminary moving-bar or number menu to choose from among basic system functions—backup, verify, restore, directory, or utilities. At the next level down, you're given more intimate control, selecting paths and files as well as setup options.

The various defaults can be selected and loaded into the menu by scripts (which can themselves be generated by menu

FACT FILE

Data 128
Advanced Digital Information Corp., P.O. Box 2996, Redmond, WA 98073; (800) 336-1233, (206) 881-8004.
List price: With one cartridge, adapter card, drive, and *Data* software, $2,295.
Requires: 512K RAM, DOS 2.0 or later.
In Short: A SCSI-interfaced minicartridge tape drive with a capacity of 86MB (128MB using the newer DC 2128 tapes) per tape and a data transfer rate of over 3MB per second. While fast and capacious, its price renders the system better suited for network use than for single PCs.

CIRCLE 544 ON READER SERVICE CARD

choices). Options include full backups, partial backups selected by archive bit, and inclusion or exclusion of specific files. The system stores a directory on every tape.

The restoration menu works like backups and allows three main modes of restore: all files, files modified since the last restore, and individual file.

The system requires 86MB or 128MB preformatted cartridges, of which ADIC offers five for $251.75. (One comes free with the base system). You can also format tapes yourself with the *Data* software; formatting an 80MB cartridge takes about 40 minutes. Reusing cartridges does not mean reformatting, because a menu selection will allow new backups to overwrite old ones.

The Data 128 system is fast and capacious. While it remains too costly for single-user PCs, in network applications its speed may be enough to overcome qualms about its high price.

FACT FILE

Alloy Retriever/60
Alloy Computer Products Inc., 165 Forest St., Marlboro, MA 01752; (800) 451-8753, (508) 481-8500.
List Price: With *ResQ* and *ResQNet* software and one extended-length data cartridge, $449.
Requires: IBM AT compatible with floppy disk drive logic cable, power connector for second floppy disk drive, and empty internal half-height drive bay; 256K RAM; DOS 2.1 or later.
In Short: The Alloy Retriever/60 is a standard QIC-40 style hard drive that can also be used with 60MB tapes. It's no speed demon, but its flexibility is valuable. The two included software packages, *ResQ* and *ResQNet*, use reasonably clear tree-style menus for running backup and restore operations on networked as well as standalone PCs.

CIRCLE 545 ON READER SERVICE CARD

ALLOY COMPUTER PRODUCTS INC.

Alloy Retriever/60

by Bruce Brown

The Alloy Retriever/60 internal tape drive gives you more for your money than do some other QIC-40 drive vendors. For a list price of just $449, you get software for using the drive on network file servers as well as on standalone PCs. In addition, using 205-foot standard DC 2000 tapes, the Retriever/60 will format up to 40MB. With 307-foot tapes, the potential capacity increases to 60MB.

Other vendors obviously like Alloy's combination of hardware and software: both CMS Enhancements and Procom Technology package the company's drives and versions of its *ResQ* backup and retrieval software under their own names. Under the CMS label, the Alloy drive commonly has a street price of close to $300. And Procom offers an external version, the Model PXT-40-500, including adapter card, software, and one unformatted tape, for $750.

The Alloy Retriever/60 is a belt-driven, 5.25-inch half-height drive. You hook up the Retriever/60 directly to your floppy controller, most commonly using the drive B: cable; however, you can choose to configure the Alloy unit as any one of four system floppy disk drive units. You should not enter the tape unit as a floppy disk drive in your system's setup program—that will just confuse matters, as all control of the Retriever/60 is via the drive's own software.

TREE-STRUCTURE MENUS

The *ResQ* backup program files occupy about 278K of hard disk drive space. *ResQ* uses fairly simple tree-structure menus for all operations. You can activate various program commands by tapping a single letter key, by selecting an option with a mouse, or straight from the DOS command line.

A group called the Primary Commands controls backing up and restoring files and displaying a directory of the files on a tape. The Miscellaneous Command group controls such utilitarian tasks as tape formatting and erasure, and creating *ResQ* macro files called AutoTIP files. You can run AutoTIP files from the DOS command line or you can schedule them to run once or on a regular basis.

Scheduling is done through the included TIPTOK program, which, among other options, lets you run macro files in intervals of from 1 to 31 days.

You can make only file-by-file backups with the Retriever/60 and *ResQ*. You can't do image backups, which are usually quicker but ultimately less useful than the file-by-file backups. You can back up and restore a single file or directory, tagged files or directories, subdirectories, and whole drive partitions. You can also back up modified files only. Each backup is named with up to 44 characters; a backup session may consist of any number of files or tapes.

A single backup may span several tapes, or you might have many backups on one tape. Each backup may be protected with a one- to eight-character password. You can restore files to any directory, drive, or anything that DOS thinks is a drive, including RAM disks and devices like Bernoulli cartridges.

The Retriever/60 performed well on our benchmark tests, though not as quickly as some of the other QIC-40 units. The Alloy tape unit took 26 minutes to back up 43MB of data in the Full Disk Backup performance test and 33 minutes to restore the same data to the hard disk. Formatting 40MB data cartridges took a fairly standard 44 minutes.

The Alloy Retriever/60 delivers value in the form of flexibility. With the potential to format tapes for either 40MB or 60MB and the inclusion of software for standalone PCs and networks, the system rates as a good buy.

ARCHIVE CORP.

ArchiveXL Model 5540

by Bruce Brown

The ArchiveXL Model 5540 emerges as a clear front-runner of QIC-40 standard drives. Price, construction quality, software, and performance are all outstanding features of this unit.

Though Archive Corp.'s product lists for $499, including *QICstream* software, you can find it for about $329 from a variety of mail-order dealers. Like the other QIC-40 drives, the unit uses 3M DC 2000 tapes; Archive itself does not sell preformatted tapes.

The Model 5540 is a half-height, internal 5.25-inch-form-factor drive that gets its power directly from the PC in which it's installed. This unit has been built for durability—it boasts a cast-aluminum chassis for strength and a direct-drive motor for

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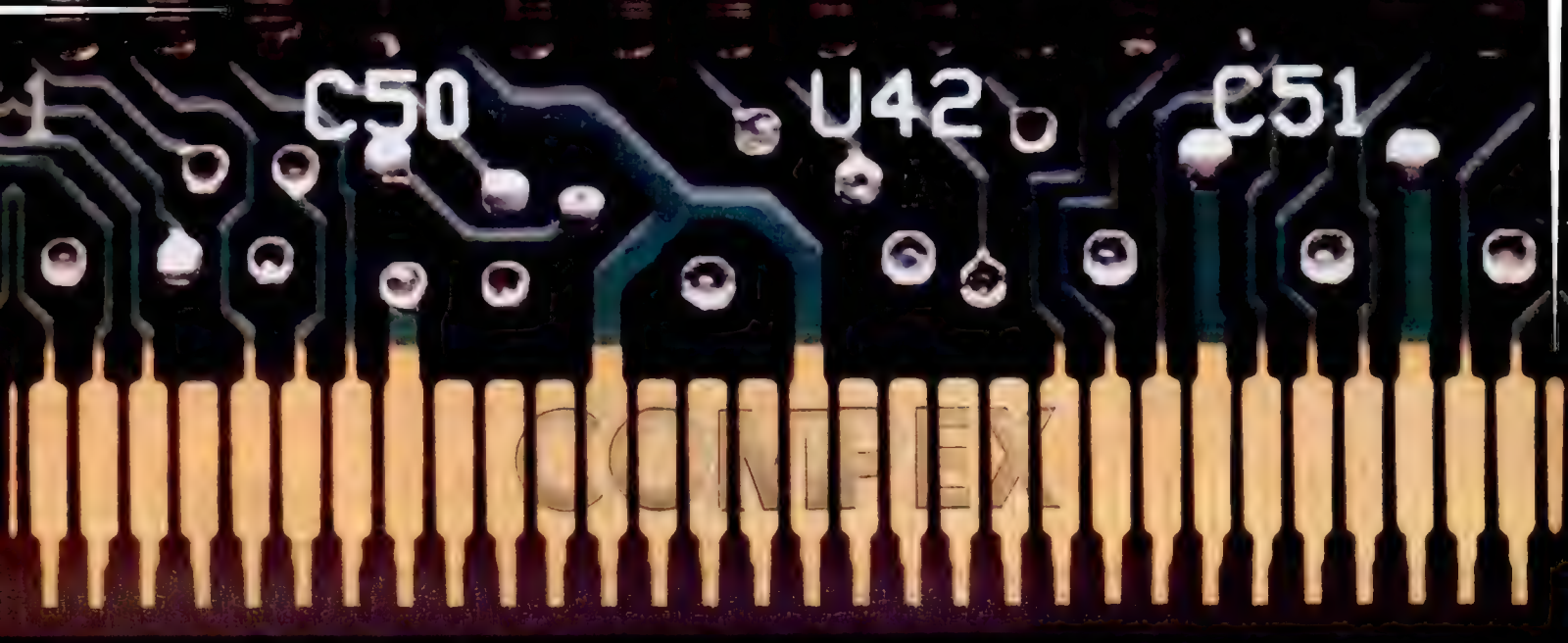

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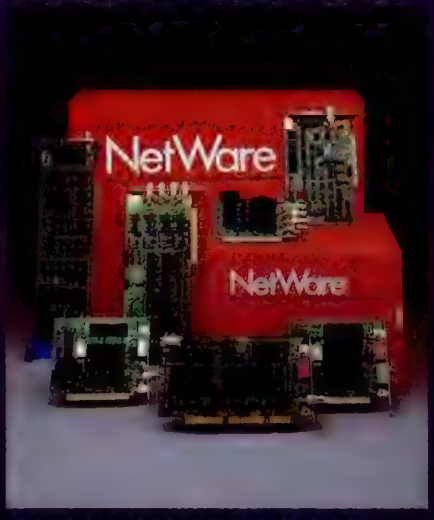

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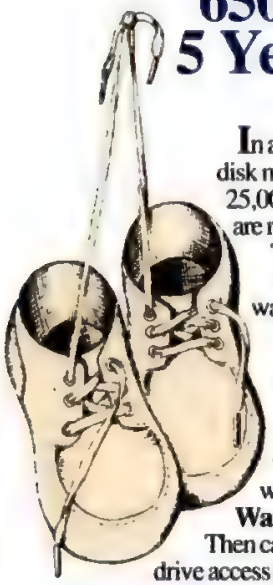

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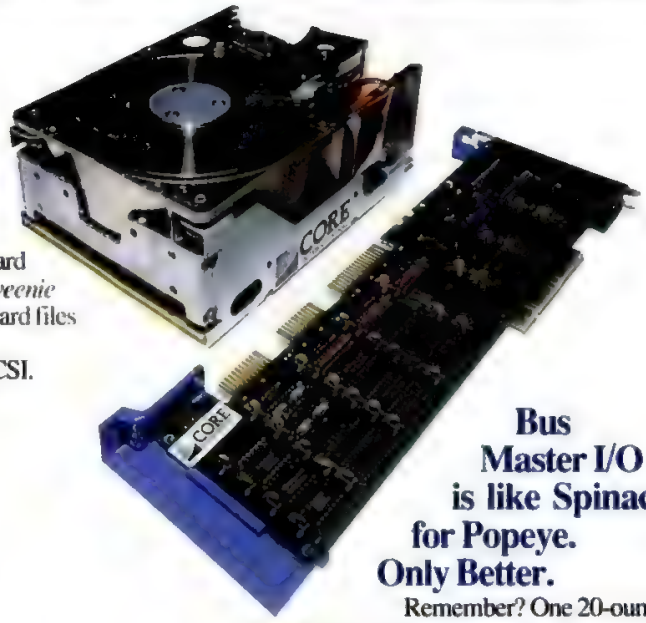

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consistent tape speed. Inserted tapes don't protrude from the unit; to extract them, you push a button on the front of the drive. This is a welcome change from units in which the tape extends about one half inch from the drive, and releasing the storage media involves physically pulling it out.

INSTALLING THE SYSTEM

The simplest way to install the ArchiveXL is to slide it into an empty drive bay and connect the floppy disk drive B: cable and a power lead to its back. (You can install the Archive as a third or fourth floppy disk drive if you already have two or three floppy disk drives.) Because the tape unit works with its own software, you don't change your setup program to reflect the tape drive's presence.

The *QICstream* backup utility, which runs in the foreground only, uses clear menus to direct you through all the steps in backing up and restoring data. When you start *QICstream*, you can specify verification of all backups; otherwise, verification is a separate menu choice. You can also command *QICstream* not to sort directories as they are backed up and not to set the archive bit when a file has been backed up. The latter option is especially valuable when you're performing an unusual, extra set of backups, which would disturb routine practice if the archive bit were set.

You cannot do an image backup with the ArchiveXL; all backups use the file-by-file method. You can back up a single file, single or multiple directories including subdirectories, or whole disks. You have the same options for restoring files. You can restore files to any directory or drive—not just to the place from which the files came. To save tape space and backup time, you can set the program to back up just those files that are new or that have changed since the last backup.

NAMING BACKUPS

Every time you make a backup with *QICstream*, you must enter an identification

CORE TACKLES THE LOW END

by Robert Kendall

While CORE International has long been a respected vendor of tape backup drives, the company has concentrated its efforts mostly on very-high-capacity models sporting correspondingly high price tags. Times change, however. Now the company is making a strong push for the lower-capacity backup market with a new 80/120MB drive, the COREtape CT80/120. We examined a very promising beta-test version of this product, which will supersede CORE's old 40MB QIC-40 floppy-interface unit.

For an irresistibly low price of $349 (for the internal version), the CT80/120 will store 80MB of data on DC 2080 tapes or 120MB on DC 2165 tapes using QIC-80 format. Data compression allows you to pack a substantial 240MB on a DC 2165. Thus, the product not only undercuts the price of most 40MB drives but also provides a real bargain alternative for higher-capacity backup.

INSTALL LIKE A FLOPPY

You install the CT80/120 like a floppy disk drive, connecting it to your system's disk controller. The drive comes bundled with CORE's easy-to-use COREtape software. It will perform an image or file-by-file backup of your entire DOS partition, or let you tag individual directories or files on-screen for inclusion. You can tag files globally by date or by name using wildcards, or back up only those with the archive bit set. Once you've selected the material to back up, you can save the selection criteria as a backup catalog for reuse later.

You can specify that each backup overwrite the previous one or be appended to it, and resetting the archive bit of backed-up files is optional. The program also allows execution from a batch file or automatically at a later time. There's even password protection.

If you don't want to restore the entire backup, you can call up a directory of the tape contents and tag the files you want. Or you can simply type a single filename or path specification. According to the vendor, the software will include a rather unusual feature: it will let you restore a single file from an image backup of your entire disk. This feature wasn't yet functional on the CT80/120 at review time, but the vendor notes it is currently available on all other CORE units. Another attractive new feature speeds searches—to within *1 minute*—for individual files by reading the data on the tape in randomly accessed blocks rather than sequentially.

During backup and restore, a progress screen estimates the percentage of the task completed and displays time elapsed and the number of kilobytes written. This screen also lists each file and directory as it's backed up, along with any errors that might occur. The program will optionally write this list to disk as a log file.

Out of curiosity, PC Labs ran on the CT80/120 the same performance tests that challenged the fully reviewed products in this feature. The result? We met with a couple of surprises.

NOT-SO-IDLE TESTING

The tape drive was able to complete all our tests successfully, retaining data integrity and presenting no major problems. Our version couldn't restore the backed-up contents of a single directory to a different directory, although it could tack the restored directory onto a new parent directory. And while the vendor told us the software had not yet been fully optimized for speed, the drive nevertheless turned in faster performances than many of its higher-priced competitors.

If speed is your primary concern, you may wish to consider the company's newly released 125MB COREtape CT125, which uses a $195 SCSI controller interface board for faster data transfer. The external version sells for $1,700, and an internal unit should be available by press time. This drive uses the same software and offers the same features as the CT80/120. There's also the older $1,295 COREtape CT60, a 60MB unit that uses DC 600 tapes and the QIC-02 format.

The COREtape CT80/120 should prove a strong contender in the low-end market. With an unbeatable price, flexible and simple-to-use software, and surprisingly good performance even in its beta-test form, this newcomer has a good shot at making 40MB tape backups obsolete. ■

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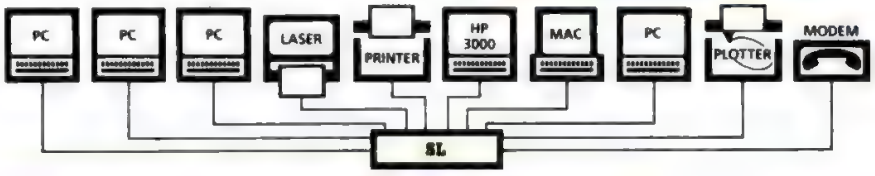

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name for the backup; the name can use up to 44 characters. When I backed up a whole drive, for example, I named the backup Everything, but when I backed up just the directory C:\D2, I named it Drive C: Directory \D2. You can also enter an optional password for any given backup, using up to eight characters.

You can have as many full or partial backups as will fit on a tape, each with its own name and password. When you start a backup, *QICstream* determines whether or not it will all fit on the present tape; if it won't, the software gives you the opportunity to start with a new tape or to have the backup span across tapes.

To automate backup operations, *QICstream* has a macro capability that lets you save valid *QICstream* command files. From within *QICstream* you can schedule macros to run either at a specific time and day or on a weekly basis. You can schedule up to 17 macros.

The ARCHIVEXL system performed very well on our benchmark tests. Formatting a blank tape took the average 44 minutes. We both backed up and restored our 43MB test file at an approximate clip of 2MB per minute.

Archive Corp.'s ArchiveXL is a good choice for obvious reasons. If 40MB tapes fit into your backup scheme, the ArchiveXL, with its *QICstream* software, gives you solid construction, ease of installation and use, and good performance—all at a reasonable price.

FACT FILE

ArchiveXL Model 5540
Archive Corp., 1650 Sunflower Ave., Costa Mesa, CA 92626; (800) 237-4929, (714) 641-1230
List Price: $499
Requires: IBM AT compatible with half-height drive bay, 256K RAM, DOS 3.0 or later.
In Short: The ArchiveXL is a well-made QIC-40–standard drive that's easy to connect and has very good backup and restore times. The included *QICStream* backup utility software uses an exceptionally clear menu system to control all operations.

CIRCLE 548 ON READER SERVICE CARD

BACKUP

DC 2000 TAPE DRIVES

EVEREX SYSTEMS INC.
Excel 40AT
by Winn L. Rosch

Everex seems to make just about anything you can plug into a PC—and the PCs to boot. But of all its slide-in options, its tape drives are among the best—fast, reliable, versatile, affordable, and well built. The $499 minicartridge-based Excel 40AT is a prime example.

An internal unit, the Excel 40AT drive arrives preconfigured to plug directly into an IBM PC AT or compatible. It's already adapted from its native 3.5-inch form factor to a half-height, 5.25-inch drive space. Even AT-style drive-mounting rails are installed.

Completing the system's installation is a breeze. A standard 5.25-inch floppy-disk-drive edge-connector extends from the rear of the main circuit board of the 40AT, so it plugs directly into a standard cable in lieu of your B: drive. A SIPP-style terminating resistor is socketed behind the connector for properly matching the load of your existing system.

PC'S SHINING STAR

Installed in a drive slot, the Excel will be the shining star of your AT. Six LED indicators along the front panel glow in various colors to indicate operations. From the left, the indicators are SEL (green), to let you know your system knows the drive is there and working; Read, Write, FWD, and REV (all yellow), to monitor drive operation and the direction of tape motion; and Power (red), just to reassure you that the volts are there.

The drive is built around a die-cast aluminum chassis to which the vital mechanical parts and the two circuit boards attach. The double-belt two-motor drive mechanism uses a smooth friction belt to move the tape capstan; a second, cogged belt drives a screw that raises and lowers the read/write head to the appropriate track. The drive runs more quietly than most, except during its initial edge-seeking operation, when it buzzes loudly.

The Excel 40AT uses the QIC-40 tape format, which ensures compatibility but requires that you format tapes before you first use them—a 40-minute operation. Everex does not sell preformatted tapes, but it does sell unformatted DC 2000 tapes for $25 each. As this issue went to press, Everex was shipping the Excel 40AT supporting extended-length tapes, with capacities of 60MB.

THE EVEREX SOFTWARE

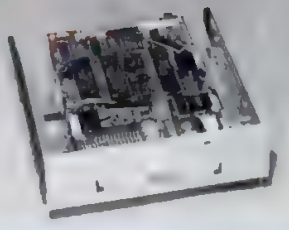
The Everex *Floppy Tape* software includes just about every backup and restore function known. Both image and file-by-file modes, with every selection option you could want, are supported. (One shortcoming: before restoring files to a new directory, you must manually create the directory.) Its two integrated menu-driven interfaces are geared to different experience levels.

The beginners' interface, despite its name, provides enough options for nearly any normal backup operation. Most of its controls are activated through function keys consistently assigned throughout its multilayer cake of menus, although the constant need to confirm almost every keystroke is bothersome.

The advanced interface gives you more intimate control. During image restoration, for example, it allows you to reallocate data away from bad disk sectors. For really advanced users or for anyone who wants to create batch files, command-driven and Novell-compatible software is included.

Now the program's big pratfall: image

FACT FILE
EDITOR'S CHOICE



Excel 40AT
Everex Systems Inc., 48431 Milmont Dr., Fremont, CA 94538; (800) 821-0806, (415) 498-1111.
List Price: With software and one unformatted cartridge, $499
Requires: IBM AT or compatible, 512K RAM, one half-height drive bay, DOS 3.0 or later
In Short: A fast, QIC-40–compatible tape backup system that runs from your floppy disk controller and yields both image (for partitions smaller than 32MB) and file-by-file backups. Its software allows both menu and command operation in the foreground or background.

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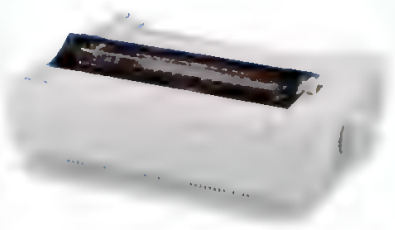

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5410 ☐QuickC 2.01 w/Assembler . . . . . 139.
2880 ◘Macro Assembler 5.1. . . . . 99.
2859 ◘Fortran Compiler 5.0 . . . . . 289.
2853 ◘C Compiler 5.1 . . . . . 299.

Monogram ... NCP
2778 ◙Dollars and Sense 3.1 . . . . . 105.

Mouse Systems ... NCP
5739 ◙Power Panel 1.0. . . . . 59.
5995 ◙Marq Plus 1.0 . . . . . 59.

Multisoft ... NCP
4924 ☐Super PC-Kwik 3.3 . . . . . 49.
4925 ☐PC-Kwik Power Pak 1.3 . . . . . 79.

Nantucket Software ... NCP
2970 ◙Clipper *(Summer '87)* . . . . . 429.

New England Software ... NCP
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2987 ☐Timeslips III 3.4..... 169.

Norton-Lambert ... NCP

4928 ☐Close-Up Customer 3.0..... 135.
4929 ☐Close-Up Support 3.0..... 165.
5420 ▣Close-Up LAN *(8 user)*..... 529.

On Track Computer Sys. ... NCP

5490 ▣Disk Manager 4.0..... 65.

Owl International ... NCP

3080 ☐Guide 2.0..... 143.

Paperback Software ... NCP

3142 ☐VP-Planner Plus 2.0..... 145.
3138 ☐VP-Expert 2.1..... 145.

Personics ... NCP

3126 ▣SeeMORE 2.0..... 54.
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3153 ◙Norton Editor 1.3..... 45.

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3221 ☐Expanded Memory Mgr. 386 5.0.. 59.
3220 ☐DESQView 2.26..... 79.
4586 ☐DESQView 386..... 129.

Reference Software ... NCP

4396 ◙Grammatik IV 1.0..... 52.

Revolution Software ... NCP

4480 ◙VGA Dimmer 2.01 *(screen saver)*.. 19.
3254 ◙Cruise Control 3.02..... 39.

Rightsoft ... NCP

4155 ◙Rightwriter 3.1..... 54.

Samna ... NCP

5148 ☐Ami 1.0A..... 129.
5799 ◙Ami Professional 1.0..... 319.

Simon & Schuster ... NCP

3314 ☐Typing Tutor IV 1.0..... 33.

Softlogic Solutions ... NCP

3546 ☐Disk Optimizer 4.05..... 45.
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Software Publishing ... NCP

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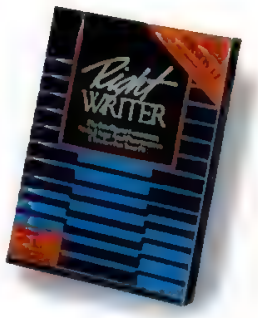
3499 ☐PFS:First Publisher 2.1..... 79.
4342 ◙PFS:First Graphics 1.0..... 89.
3478 ☐PFS:First Choice 3.02..... 105.
3496 ◙Professional Write 2.11..... 139.
3493 ◙Professional File 2.01..... 189.
3482 ◙Harvard Graphics 2.12..... 299.
4669 ◙Harvard Graphics Access. Pk 1.0 299.
4284 ◙Harvard Project Manager 3.0... 439.
5992 ▣Office in a Box *(includes First Choice, Quicken, First Publisher)*..... 159.

Spinnaker ... NCP

4441 ☐Resume Kit 1.29..... 25.
4446 ☐8-in-1 2.0..... 39.
4444 ◙Splash 1.0..... 59.

Symantec ... NCP

5383 ▣Budget Express 1.0..... 105.
3427 ◙Q & A Write 1.01..... 139.



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4185 ▣Scrapbook+ 1.0..... 85.

TOPS ... NCP

3724 ▣NetPrint 2.0 *(share printers)*..... 119.
3726 ▣TOPS 2.1..... 115.
3725 TOPS Repeater *(network extender)* 129.
3720 *Flashcard 2.1 (AppleTalk network card; 1 year warranty)*..... 159.
4716 ▣InBox Personal Connection 2.2.. 59.
4712 ▣InBox 100 User 1.0..... 349.

Traveling Software ... NCP

4190 Battery Watch 2.0 *(3½" only)*..... 35.
3729 ◙LapLink Mac 2.0 *(Mac-PC transfer)* 79.
5179 ◙LapLink III 3.0..... 85.
4891 ◙ViewLink 1.0..... 95.
3727 ◙DeskLink 2.21..... 99.

True BASIC, Inc. ... NCP

3561 ◙True BASIC 2.1..... 52.

Vericomp ... NCP

3765 ◙SoftBytes 2.0..... 35.

Volkswriter ... NCP

5046 ▣Volkswriter 4 *(w/Correct Grammar)* 109.

WordPerfect Corp. ... NCP

3799 ◙WordPerfect Library 2.0..... 75.
3804 ☐WordPerfect 5.1..... call
3805 ▣WordPerfect Network 5.1..... 389.
3806 Additonal Network Stations 5.1.... 89.

WordStar USA ... NCP

2825 ☐WordStar Prof. Release 5.5.... 229.
5000 ☐*Upgrade to Release 5.5*..... 89.

Wordtech Systems ... NCP

3810 ☐DBXL 1.3..... 145.
3811 ☐Quicksilver 1.3..... 349.

Xerox ... NCP

4539 ◙Professional Extensions 1.0.... 399.
3812 ☐Ventura Publisher 2.0..... call

XTREE Co. ... NCP

4512 ◙XTREE Pro 1.1..... 79.

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4433 □Jack Nicklaus: Greatest 18 Holes. 32.

Broderbund ... CP

1413 □Where/World Carmen Sandiego? . . 25.
1414 □Where/USA Carmen Sandiego?. . . 25.
1417 □Where/Europe Carmen Sandiego? 29.
5701 □Where/Time Carmen Sandiego? . . 32.
5851 ◉Sim City..... 33.
4948 ◧JetFighter *(by Velocity)*..... 35.
6036 □Family Software Library *(incl. Bank St. Writer, Where/Europe Carmen Sandiego, and Type)* ..... 59.

Electronic Arts ... CP

5798 □Ferrari Formula I ..... 29.
5806 □F-16..... 35.
5805 ◉Starfleet II ..... 45.
5803 □Battle of Britain ..... 45.
5804 ◉Deluxe Paint II *(Enhanced)*..... 89.

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2671 ◧Math Rabbit *(ages 4 to 7)*..... 26.
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2674 ◧Writer Rabbit *(ages 6 to 12)* ..... 29.
2669 ◧Rocky's Boots *(ages 9 to adult)* . . 32.

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5730 □F-15 Strike Eagle II..... 39.
4454 □F-19 Stealth Fighter ..... 39.
5823 □Red Storm Rising..... 39.

Microsoft ... NCP

2858 □Flight Simulator 4.0 *All New* ..... 39.

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4897 □Gauntlet ..... 29.
4695 ◧Balance of Power 1990 ..... 33.

Parlor Software ... CP

3159 □Bridge Parlor 2.3..... 49.

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3401 ◉Mother Goose *(ages 4 to adult)* . . 19.
3405 ◉Thexder..... 24.
4752 ◉Gold Rush..... 25.
3392 ◉Leisure Suit Larry I..... $25.
4455 ◉Leisure Suit Larry II ..... 33.
6023 ◉Leisure Suit Larry III..... 39.
4345 ◉King's Quest IV *(512k version)* with Free Hint Book ..... 33.
4399 ◉Manhunter: New York ..... 33.
5695 ◉Manhunter: San Francisco..... 33.
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3404 ◉Space Quest II..... 33.
5106 ◉Space Quest III *(w/free Hint Book)* 36.
6022 ◉Colonel's Bequest ..... 36.

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5993 ◉Welltris *(Tetris sequel)*..... 22.
3467 ◉Tetris *(addicting mind teaser)* .... 22.
4283 ◉Falcon/AT *(F-16 simulation)* ..... 32.
5187 ◉VETTE!..... 32.

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4437 □Kids on Keys *(ages 4 to 9)* ..... 19.
4439 □Kinder Comp Gold *(ages 3 to 8)*. . 25.
4434 □Facemaker Gold *(ages 3 to 8)* . . . 25.
4631 □Kidwriter Gold *(ages 6 to 10)* .... 32.
5580 □Sargon IV ..... 32.

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3435 ◉My Letters,Numbers,Words *(2 to 6)*22.
5231 ◉Phonics Plus *(ages 4-8)*..... 22.
3438 ◧1st Math *(ages 4 to 8)*..... 22.
3439 □2nd Math *(ages 7 to 16)*..... 27.

Sublogic ... NCP

3335 □Jet *(requires CGA or EGA)*..... 33.
6026 □UFO ..... 32.

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◧Kemeny/Kurtz Math Series:
18 titles..... *each* 39.

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□ *2nd Math*–Interactive tutorial and 7 games "teach" then "test" beginning addition through pre-calculus. Ages 7-16..... $27.

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AST Research ... 2 years

1223 I/O Mini 2 C/S/P ..... 89.
1302 SixPakPlus 64k C/S/P..... 129.
1299 SixPakPlus 384k C/S/P..... 189.
4107 RAMpage Plus 286 512k..... 419.
4105 RAMpage Plus MicroChannel 512k 469.

Brother International ... 1 year

5787 HL-8e Laser Printer..... 1899.
5788 HL-8Ps PostScript Laser Printer . . . call
5786 Toner/Drum Kit..... 99.

Central Point ... 1 year

5042 Copy II PC Deluxe Option Board . . 115.

Spectrum Holobyte ... NCP

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1713 Filtered SafeStrip SPF-3 ..... 24.
1694 Emerald SP-2 ..... 36.
1707 Ruby SPF-2 *(6 outlets; EMI/RFI filtered; 6 ft cord)* ..... 55.
1708 Ruby-Plus SPF-2 Plus *(w/FAX & modem protection)* ..... 65.

DacEasy ... 1 year

ACCELERATORS

3211 Breakthru 286-8 *(8 MHz)* ..... 225.
3210 Breakthru 286-12 *(12 MHz)* ..... 349.

Diconix ... 1 year

5655 150 Plus Printer *(Parallel)* ..... 359.

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5183 LQ-510 *(80 col., 180 cps, 24 pin)* .. 349.
1930 LQ-850 *(80 col., 264 cps, 24 pin)* .. call
4117 LQ-950 *(110 col., 220 cps, 24 pin)* .. call
1917 LQ-1050 *(136 col., 264 cps, 24 pin)* call
4116 LQ-2550 *(136 col., 333 cps, 24 pin)* call
5184 LX-810 *(80 col., 180 cps, 9 pin)* ... 199.
1052 Printer-to-IBM cable *(6 feet)* ..... 15.

5th Generation ... 1 year

3952 Logical Connection 512k ..... 529.
4921 Logical Connection 1 Meg ..... 659.

Hayes ... 2 years

2304 Smartmodem 1200 ..... 289.
2305 Smartmodem 1200B *(w/Smartcom II)* 289.
2306 Smartmodem 1200B *(hardware only)* 259.
2307 Smartmodem 2400 ..... 429.
2308 Smartmodem 2400B *(w/Smartcom II)* 429.
2309 Smartmodem 2400B *(hardware only)* 399.

Hercules ... 2 years

2318 Graphics Card Plus ..... 189.
5120 VGA Card ..... 189.

Intel ... 5 years

2400 bps Modems–Reliable connections, 100% Hayes compatibility, and a great price.

2400EX (external) ..... $179.
2400B Classic (internal) ..... $159.
2400B Modem 2 (internal microchannel) . $249.

Intel ... 5 years

4696 2400B Internal Modem ..... 159.
5847 2400B Internal Modem w/Crosstalk Remote 2 *(Thru Dec. 31)* ..... 219.
2352 2400B Internal Modem 2 *(for PS/2)* 249.
5119 2400 Baud External Modem ..... 179.
5842 2400 Baud Ext. Modem w/Crosstalk Remote 2 *(Thru Dec. 31)* ..... 239.
2346 Inboard 386/PC w/1 Meg ..... 579.
4646 Inboard 386/PC Piggyback 4 Meg 1249.
2339 Inboard 386/AT *(req. inst. kit)* .... 859.
2338 Inboard 386/AT Installation Kit .... 139.
4266 Above Board Plus 512k ..... 419.
4267 Above Board Plus I/O 512k ..... 449.
5336 Above Board Plus 8 2 Meg ..... 699.
5342 Above Board Plus 8 I/O 2 Meg ... 739.
4272 Above Board 2 Plus 512k ..... 469.
4339 Above Board Plus Piggyback w/2 Meg *(upgrades to 6 Meg)* ..... call
4275 Connection Coprocessor ..... 769.
4857 Visual Edge ..... 449.

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☐*DESQView 386 1.0*–Alows your 386 based computer to multi-task your favorite DOS applications and better manage the memory installed in your system ..... $129.

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2374 8087-2 *(for 8 MHz 8088 CPU's)* .. $129.
2368 80287 *(for 6 MHz 80286 CPU's)* ... 135.
2370 80287-8 *(for 8 MHz 80286 CPU's)* . 199.
2369 80287-10 *(for PS/2 Models 50 & 60)* 229.
4750 80387SX *(for 80386SX CPU's)* .... 309.
2371 80387 *(for 16 MHz 80386 CPU's)* .. 349.
2372 80387-20 *(for 20 MHz 80386 CPU's)* 399.
4121 80387-25 *(for 25 MHz 80386 CPU's)* 499.

Kensington Microware ... 1 year

2581 Masterpiece ..... 94.
2582 Masterpiece Plus ..... 109.
4974 PowerTree 50 ..... 54.
5697 Expert Mouse *(Trackball for PS/2)* . 115.

Key tronic ... 3 years

2537 101 Keyboard ..... 99.
4518 101 Plus Keyboard ..... 99.

Kraft ... 5 years

5801 New Game Adapter *(2 game ports)*. 27.
5800 3 button Thunder Joystick ..... 29.
5813 ThunderStick w/new game adapter 55.
4292 3 button Joystick w/game adapter . 45.
5802 Trackball ..... 69.

Kraft ... 5 years

ThunderStick with New Game Adapter–All new bundle! Be ready to try out the latest game with the new Kraft ThunderStick and game card bundle. Both newly designed and packed with features ..... $55.

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5464 Series 2 Mouse *(C9 for PS/2's)* .... 65.
5151 HiREZ Mouse *(C9)* ..... 79.
6029 Trackman *(Trackball, serial)* ..... 85.
6028 Trackman *(Trackball, bus)* ..... 89.
5152 Mouse w/Paint Show *(C9)* ..... 99.
4297 ScanMan Plus *(hand scanner)* ... 185.

Magnavox ... 2 years

5990 13" VGA Monitor *(CM9032)(1 yr. wrnty.)* 349.
4760 13" Hi-Res Monitor *(9CMO53)* ... 369.
4761 13" VGA Monitor *(9CMO62)* ..... 389.
4762 13" VGA Monitor *(9CMO82)* ..... 449.

Micron Technology ... 2 years

5818 Beyond 640 EMS Board 1 MB *(exp. to 8 MB w/daughter card)* ..... 369.
5821 Beyond EX Extended Memory Board 2 MB *(exp. to 4 MB w/daughter card)* ..... 599.
6014 Beyond EMS Board for PS/2 Model 80 *(1 Meg)* 339.
6005 Ascend Mem. Board for Compaq *(4 Meg)* ..... 729.

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Microsoft ... lifetime

2870	Mach 20 *(1 year warranty)*	$349.
2897	Mouse with Paintbrush	109.
2898	Mouse with Windows 286 2.1	139.

MicroSpeed ... 1 year

6007	PC-TRAC Trackball *(serial version)*	75.
6008	PC-TRAC Trackball *(bus version)*	85.
6010	FastTRAP 3D Trackball *(serial version)*	99.
6009	FastTRAP 3D Trackball *(bus version)*	109.

Mouse Systems ... lifetime

5994	OmniMouse II w/PC Paint Plus	49.
5845	White Mouse *(bus or serial)* w/PC Paint Plus and Power Panel *(thru Dec. 31)*	69.
5997	Trackball *(serial version)*	75.
5996	Trackball *(bus version)*	85.
4306	PC Mouse II w/PC Paint+	89.

NEC ... 2 years

4799	Multisync 2A *(VGA Monitor)*	499.
5085	Multisync 3-D Monitor	689.

Orchid Technologies ... 4 years

3069	Tiny Turbo 286 *(accelerator board)*	219.
4765	Designer 800 VGA *(360 x 480)*	159.
4690	ProDesigner VGA *(800 x 600)*	249.

MicroSpeed ... 1 year

PC-TRAC Trackball–Small and lightweight, self-adjusting resolution from 50 to 1000 dpi. *PC-TRAC serial*.. $75. *PC-TRAC bus*.. $85. *FastTRAP*–Trackball with a Trackwheel provides third axis pointing capability. *FastTRAP serial* . $99. *FastTRAP bus* . $109.

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3202	Turbo Cool 150 *(25° - 40° cooler)*	129.
3205	Turbo Cool 250 *(25° - 30° cooler)*	169.
3200	Silencer 150 *(84% noise reduction)*	115.
4514	Turbo Cool 375	299.

Practical Peripherals ... 5 years

3101	1200 Baud Internal Modem	69.
3100	1200 Baud External Modem *(mini)*	77.
3097	Microbuffer Inline *(parallel print buffer/32k)*	135.
3103	2400 Baud Internal Modem	139.
3102	2400 Baud External Modem	179.
5285	2400 Baud Ext. MNP Modem *(Lev. 5)*	209.
4542	2400 Baud Internal Modem for PS/2	229.

Princeton Graphics ... 1 year

3166	Ultrasync *(800 x 600 max. res.)*	549.

Safe Power Systems ... 2 years

4561	Safe 250W *(standby power bkup)*	249.
4562	Safe 425W *(standby power bkup)*	369.
4563	Safe 500W *(standby power bkup)*	495.

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Inboard 386/PC–Brings advanced computing power to your PC/XT system. Includes 16Mhz 80386 processor and 1Mb RAM. Flexible 32-bit memory expansion options are also available ..... $579.

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5107	Floppy Drive Controller *(S/P)*	99.
5109	SOTA VGA/16 *(with 256k)*	219.
5111	SOTA 286i-12 *(12 MHz accelerator)*	299.
5402	SOTA 386i-16 *(16 MHz accelerator)*	419.

Targus ... lifetime

4899	Nylon Laptop carrying case	55.
4901	Premier leather carrying case	199.

TheComplete PC ... 2 years

4889	TheComplete Hand Scanner 400	159.
5598	TheComplete Half Pg. Scanner 400	189.
4887	TheComplete FAX 9600	429.
5140	TheComplete Page Scanner	549.
5828	TheComplete Communicator	559.

OCR SOFTWARE

5789	TheComplete OCR/HS 1.0	199.
5807	TheComplete OCR/Page 1.0	319.

Toshiba ... 1 year

3684	T1000 Laptop *(80C88, 6.4 lbs.)*	669.
4856	T3100E Laptop *(12 MHz, 20 Meg)*	2749.
4958	T1600 Laptop *(12 MHz, 20 Meg)*	3249.

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1024i–New! Interlaced, Super VGA adapter. Fastest 16-bit graphics of any DRAM-based VGA board. Supports both fixed & variable frequency analog monitors. *1024i w/256K* . $229. *1024i w/512K* . $289.

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6019	LS 600 Line Stabilizer	$85.
6018	LS 1200 Line Conditioner	159.
6017	LS 1800 Line Conditioner	209.

Video 7 ... 7 years

3778	VEGA VGA	259.
5883	1024i VGA *(includes 512k)*	289.

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2485	Bernoulli II Single 20 Meg Internal	767.
5116	Bernoulli II Single 44 Meg Internal	995.
2486	Bernoulli II Dual 20 Meg External	1659.
5117	Bernoulli II Dual 44 Meg External	1969.
4276	20 Meg Cartridge Tripak *(5¼")*	169.
5113	44 Meg Cartridge Tripak *(5¼")*	249.

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2499	PC2 Card	169.
2500	PC2B Card *(bootable card for PC/XT/AT)*	229.
2502	PC4 Card *(for PS/2 Model 50/60/70/80)*	299.

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CM9032–VGA analog color monitor compatible with all 17 VGA modes. 720 x 400 text resolution & 640 x 480 graphics resolution. Analog input allows for a virtually unlimited number of colors to be displayed..... $349.

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2917	40 Meg Internal Tape Drive	379.
2915	40 Meg External Tape Drive	479.
2916	40 Meg External Tape Drive with Power Supply	569.
5378	60 Meg External Tape Drive with Power Supply	1169.
5616	150 Meg External Tape Drive with Power Supply	1495.
5499	80 Meg Internal Tape Drive	519.
5503	80 Meg External Tape Drive	629.
5190	40 Meg Data Cartridges *(pre-formatted)*	35.

Pacific Rim ... 1 year

5010	1.2 Meg External *(for PS/2's)*	215.
5011	360k External 5¼" Drive	179.

Plus Development ... 2 years

3105	Hardcard 20 Meg *(49 ms)*	549.
3106	Hardcard 40 Meg *(28 ms)*	699.
5165	Impulse 80 meg Hard Drive *(12 ms)*	879.
5163	Impulse Controller *(required)*	229.

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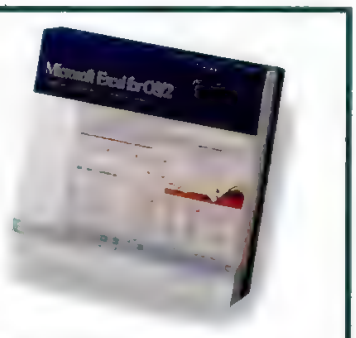
FREE PCTV® Hard Drive Installation Tape with purchase of 20, 30 or 40 Meg Seagate drive for the IBM PC (not for AT). Beta or VHS.

2285 20 Meg Internal Hard Drive ST225 *(w/controller and cables, 65 ms)* . $289.
2286 30 Meg Internal Hard Drive ST238 *(w/controller and cables, 65 ms)* . . 299.
4554 40 Meg Int. HD ST251-1 (28 ms) . . 359.
2287 40 Meg Int. HD for PC ST251-1 *(w/controller and cables, 28 ms)* . . 429.
4624 80 Meg Int. HD ST4096 (28 ms) . . 619.

TEAC ... 1 year
4950 PC, XT 360k Drive *(5¼")* . . . . . 79.
4951 720k Drive *(specify XT or AT, 3½")* . 79.
4670 1.44 Meg Drive for XT *(3½")* . . . . . 99.
4326 1.44 Meg Drive for AT *(includes Bastech software utilities, 3½" copy prot.)* . 119.

Toshiba ... 1 year
3650 AT 360k Drive *(5¼")* . . . . . 85.
3649 AT 1.2 Meg Drive *(5¼")* . . . . . 99.
4755 AT 1.44 Meg Drive *(3½", includes Bastech software utilities)* 119.



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4864 Disk Labels 3½" *(Qty. 250)* . . . . . 13.
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4807 Laser Labels 1" x 2⅝" *(Qty. 3000)* . 24.
4811 Laser Transparencies 8½" x 11" *(Qty. 50)* . . . . . 22.

CompuServe
1676 CompuServe Information Service . . 24.

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5511 Right Angle Printer cable *(6 feet)* . . . 15.
1050 Parallel Printer cable *(15 feet)* . . . . . 19.

Dow Jones ... NCP
5494 □News/Retrieval Member. Pack. . . . 24.

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3291 Sony *(10 disks per box)* . . . . . $12.
2789 Maxell MD2-D *(10 disks per box)* . . . 13.
4192 Verbatim Datalife *(10 disks per box)* . 13.

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3770 Verbatim Datalife *(10 disks per box)* . 19.
3292 Sony *(10 disks per box)* . . . . . 19.
2790 Maxell MD2-HD *(10 disks per box)* . 19.

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3772 Verbatim *(10 disks per box)* . . . . . 15.
2792 Maxell *(10 disks per box)* . . . . . 15.

3½" DS/High-Density Diskettes *(1.44 Meg)*
3298 Sony *(10 disks per box)* . . . . . 29.
3773 Verbatim *(10 disks per box)* . . . . . 29.
2793 Maxell *(10 disks per box)* . . . . . 29.

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5746 1 Meg Chips *(80 nanosecond)* . . . . call

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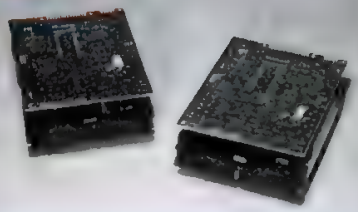
backups of partitions larger than 32MB are handled with bubble gum and bailing wire. Impossible to perform through the beginners' interface, the advanced interface permits only raw backups (complete with error message). In the case of the test system, this meant backing up both used and unused areas of the disk—68MB instead of the 43MB actually occupied by data.

Raw image backups allow only image restorations, although ordinary image backups (32MB or smaller partitions) allow the same restoration options as do file-by-file backups. But you might as well not bother with images at all, because their data rate proved no faster than file-by-file mode—the floppy-disk connection was the speed limiter.

A special program, the *Scheduler*, provides elaborate menu control for arranging backups keyed to intervals, specific times and dates, or just certain days of the week. The *Scheduler* will even wait patiently in the background.

Unless versatility in large-partition image backups is important to you, there's little to carp about with the Excel 40AT. It ranks at the top of the list for anyone looking for a fast, affordable minicartridge backup system with top-notch software.

FACT FILE



Irwin Product Group, Cipher Data Corp., 2101 Commonwealth Blvd., Ann Arbor, MI 48105; (800) 421-1879, (313) 930-9000.

Irwin 2040
List Price: With installation kit and one formatted cartridge, $699
Requires: 512K RAM, DOS 2.0 or later.

CIRCLE 548 ON READER SERVICE CARD

Irwin 2080
List Price: With installation kit and one formatted cartridge, $849.
Requires: 512K RAM, DOS 2.0 or later.
In Short: Both the Irwin 2040 and 2080 cartridge tape backup systems use a proprietary tape format that draws few complaints, owing to Irwin's popularity among big-name PC makers like IBM and Compaq. Features include easy-to-use menu- or script-driven file-by-file backup software and scheduling software for automatic backups.

CIRCLE 549 ON READER SERVICE CARD

IRWIN PRODUCT GROUP

Irwin 2040
Irwin 2080

by Winn L. Rosch

Irwin Product Group, a division of Cipher Data Corp., wears laurels like Princess Di wears hats—with quiet ostentation. The company claims it was the first to bring tape cartridges for PC backup down to size. It says it is the manufacturer of the best-selling tape drive, the drive chosen by major computer makers like IBM and Compaq to factory-pack in their PCs. With its claim to 50 percent of the market share, Irwin sidesteps the issue of industry standardization: its ubiquity makes its format a de facto standard.

The bravado is justified. Irwin truly pioneered minicartridge backup for PCs. The internal 40MB Irwin 2040 and 80MB 2080 represent the company's well-aimed stab at the state-of-the-art. Both units are sold as packages with drive, installation kit, and software. The prices are somewhat high—$849 for the higher-capacity drive, $699 for the more modest one—but they are widely discounted (about 40 percent off through mail-order retailers).

ADAPTABILITY IS KEY

One reason that Irwin sells so many minicartridge drives is adaptability—one standard drive design fits virtually any platform through computer-specific installation kits. In addition to the 2040 and 2080, the Irwin's 2000 minicartridge series includes the 20MB 2020. As this issue went to press, Irwin introduced a 120MB unit, the 2120. Unlike Irwin's other minicartridge drives, the 2120 runs from its own controller card. All units are available in internal or external configurations.

Each of these basic drives is designed for a 3.5-inch form factor and can function as a direct replacement for a floppy disk drive. Converting one to an internal unit to plug into a 5.25-inch drive bay requires Irwin's 8425 adapter kit, which includes brackets for broadening the drive, AT- and Compaq-style mounting rails, and both beige and black fascia panels. A small circuit board converts the pin-style input connector on the drive to the edge style used by bigger floppy disk drives. The kit also adds a drive-select jumper, termination resistor, and a large power connector. Other kits let you squeeze the same drive into PS/2s or other machines.

The only drawback to this kit-style approach is that you have to screw everything together. Fortunately, minimal skill and a number-one Phillips screwdriver are all that's required.

The drive chassis provides a solid mounting for all the mechanicals and the single large circuit board, rife with surface-mount components. The system has no belts to wear out or fall off; the entire direct-drive capstan motor pivots to apply pressure against the cartridge drive puck.

Head height (the placement of the head to read and write the different tape tracks) is controlled through a complex mechanism that varies with drive capacity. In the 80MB unit, a screw on the head-motor shift pivots a C-shaped cast-and-machined aluminum arm, which drives the head up and down on two steel guides. The 40MB drive uses a stamped steel arm and short plastic helix to raise and lower the head. The difference in these head mechanisms is precision—the 22 tracks used by the 2080 must be more-precisely located than the 11 tracks of the 2040.

EZTAPE SOFTWARE

All Irwin tape backup systems use the same *EzTape* software, which operates in both menu and batch modes to make file-by-file backups and restorations. No image mode is available. Its menu control system will directly operate the drive or create scripts for batch processing.

Once a script is created, it can be executed automatically at an appointed time, using the system's *EzStart* feature. Essentially an invisible memory-resident utility, *EzStart* can load and execute any DOS program or batch file or provide a list of them at whatever date and time you choose.

The *EzTape* menu system is straightforward, relying on moving bars or the initial letters of commands to control operations. Once you understand that the Esc key saves rather than cancels selections as you back through menus, the system becomes a breeze to use.

If you don't want to be bothered with using the menu, Irwin supplies three preconfigured batch files that will take care of most ordinary backup needs: full disk backups, full restores, and backups that

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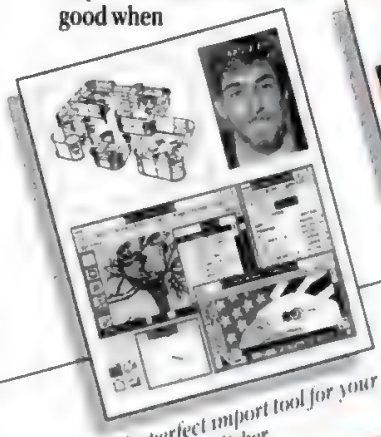

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Memory resident program takes as little as 32K. All manufacturer's names or product names are registered trademarks of their respective manufacturer. Screen images courtesy of AT&T and Facet, Inc. **CIRCLE 386 ON READER SERVICE CARD**

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508-433-5201 FAX 508-433-8466

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DC 2000 TAPE DRIVES

DC 2000 TAPE DRIVES: SUMMARY OF FEATURES

(Products listed in ascending price order)

The following commentary analyzes some of the terms and phrases in this table of features; it also includes comments about related traits. The phrases in boldface appear in the left-hand column of the table.

The **drive manufacturer** is distinct from the system integrator (identified below the product name at the top of each column).

The **system specification** lists computers with which each drive can operate. Some drives are limited by the data transfer rates of floppy disk controllers; others by the bus their interface boards use.

Formatted capacity indicates the tape's file storage capacity, not including the overhead for error correction and formatting (typically about one-third of the total tape capacity).

Formatted tape supplied by vendor: To save you the trouble of spending 40 minutes or so servo-writing and formatting tapes, many vendors supply preformatted tapes for a slightly higher price.

The **tape speed (inches per second)** indicates how fast the tape travels as files are being written. It may travel faster when shuttling forward and backward.

Operation:

■ **Memory-resident operation** The program loads into memory and stays there, potentially making automatic backups, but also subtracting from the RAM available to other applications.

■ **Background or foreground operation** Background operation allows you to back up files while using other application software. Foreground operation occurs when your backup software takes complete control of your system.

■ *Automatic operation* The system will make unattended backups at regular intervals or at an appointed time. All products reviewed have this feature.

■ *Batch-mode operation* The system allows you to define an elaborate procedure, including backup parameters and files to include or exclude, and perform it automatically by specifying a certain batch or script file. All products reviewed have this feature.

With **password protection,** access to backup files for restoration or viewing is granted only after a password is correctly entered into the control software.

Volume label on tape:
Most systems allow you to assign a title to the backup session so that the tape contents can be identified even without a paper label. All products reviewed also store a directory on each tape showing the files it contains.

Backup and restore types:

■ **Image** The backup preserves the precise structure of the original hard disk, backing up bad and unused disk sectors along with the sectors containing data. The image backup also preserves some elaborate copy-protection file schemes without modification (so you don't have to deinstall and reinstall copy-protected software when backing up).

	Alloy Retriever/60 Alloy Computer Products Inc.	**TG-1140** Tallgrass Technologies Corp.	**ArchiveXL Model 5540** Archive Corp.	PC **Excel 40AT** Everex Systems Inc.	**FileSafe TD4440** Mountain Computer Inc.
List price	$449	$495 (internal), $674 (external)	$499	$499	$595 (internal), $745 (external)
GENERAL INFORMATION					
Drive manufacturer	Alloy Computer Products	Colorado Memory Systems	Archive Corp.	Everex Systems	Mountain Computer
Drive type:					
Internal (bay size)	■ (Half-height)	■ (Half-height)	■ (Half-height)	■ (Half-height)	■ (Half-height)
External (HWD, in inches)	❑	■ (6 x 5.75 x 1.5)	❑	❑	■ (7.0 x 4.3 x 9.8)
Drive powered by host computer	■	■	■	■	■
System specification	IBM PC, XT, AT, or compatible	IBM PC, XT, AT, PS/2, or compatible	IBM PC, XT, AT, or compatible	IBM AT or compatible	IBM PC, XT, AT, PS/2, or compatible
Allows interchange with other environments	❑	■ (Xenix)	❑	❑	❑
MEDIA TYPE					
Kinds of tape used	DC 2000, DC 2000XL, DC 2120	DC 2000, DC 2000XL, DC 2120	DC 2000	DC 2000	DC 2000
Formatted capacity	40MB, 60MB	40MB	40MB	40MB	40MB
Formatted tape supplied by vendor	❑	■	❑	❑	■
Tape speed (inches per second)	50	50	50	50	50

PC—Editor's Choice ■—Yes ❑—No

N/A—Not applicable: this product does not support image backups.

DC 2000 TAPE DRIVES

■ **Modified image** Only sectors actually used for storing data are backed up, without regard to file structure.

■ *File-by-file* Each file is individually backed up, preserving its exact DOS file structure. All the drives reviewed offer file-by-file backup, including options for single files or directories.

■ **DOS partition** An entire DOS partition (drive letter) can be backed up as an image at one time.

Backup options:

■ **Append image backup** More than one image backup session can be stored on a tape.

■ *Append file-by-file backup* More than one file-by-file backup session can be stored on a tape. All systems reviewed offer this feature.

■ *Backup limited to 32MB* Some backup systems are unable to cope with partitions larger than 32MB. None of the products reviewed have this limitation.

■ *Backup across several cartridges permitted* When a backup session requires more storage capacity than a single tape offers, the data can be spread across several tapes. All systems reviewed offer this feature.

■ *Backup in progress can be terminated* Except for Sysgen's Bridge-Tape, all systems reviewed allow backups or restorations in progress to be halted (without rebooting).

■ The **maximum number of backup files** is the number of files that can be backed up in a single session.

■ The **maximum number of backup directories** is the number of directories the system can handle in a single session.

Restore options:

■ **From file-by-file backup to any directory** Files can be restored to directories other than those in which they originated.

■ *From file-by-file backup to any hard disk* With any system reviewed, files can be restored to disks with letter designations other than the one from which they were backed up.

■ **From image backup to any directory** Following an image backup, individual files can be restored to any directory.

■ *From image backup to any hard disk* The image backup can be restored to a hard disk of a different size or with a different arrangement of bad tracks from the drive on which it originated. All reviewed systems that allow image backup offer this feature.

Connects in-line with disk controller: The tape drive connects to a floppy disk controller (or the floppy section of a floppy/hard disk controller) as if it were a floppy disk drive.

Uses board connecting in-line with disk controller: The tape drive connects to a proprietary 8-bit interface board, which in turn must be connected to a floppy disk controller.

Uses standalone I/O board: The tape drive uses an 8-bit interface board that plugs directly into your system and works independently of other boards.

Tecmar QT-40i, Tecmar QT-40e Tecmar	**Bridge-Tape** Sysgen Inc.	**Irwin 2040** Irwin Product Group	**FileSafe 8000 Plus** Mountain Computer Inc.	**The Personal Archivist** Palindrome Corp.	**Irwin 2080** Irwin Product Group	**Reliant Model 510** Sysgen Inc.	**Data 128** Advanced Digital Information Corp.
$595 (internal), $795 (external)	$695	$699	$795 ($995 with Mach² controller)	$795	$849	$995 (internal), $1,195 (external)	$2,295
Wangtek	Colorado Memory Systems	Irwin Product Group	Mountain Computer	Archive Corp.	Irwin Product Group	Sysgen	3M
■ (Half-height)	❑	■ (Half-height)	■ (Half-height)	■ (Half-height)	■ (Half-height)	■ (Half-height)	❑
■ (2.5 x 5.25 x 7.75)	■ (2.2 x 6 x 10)	❑	■ (4.9 x 2.4 x 7.0)	❑	❑	■ (1.6 x 4.0 x 5.8)	■ (3 x 6.5 x 11)
■	■	■	■	■	■	■	❑ (Uses AC cord)
IBM PC, XT, AT, PS / 2 (Model 30, 50, 60, 70, or 80), or compatible	IBM PC, XT, AT, PS / 2 (Model 30, 50, 50Z, 55, 60, or 80), or compatible	IBM PC, XT, AT, or compatible	IBM PC, XT, AT, PS/ 2, or compatible	IBM PC, XT, AT, or compatible	IBM PC, XT, AT, or compatible	IBM PC, XT, AT, PS / 2 (Model 30, 50, 70, or 80), or compatible	IBM PC, XT, AT, PS / 2 (Model 25, 30, or 30-286), or compatible
❑	❑	■ (Macintosh)	❑	❑	■ (Macintosh)	❑	❑
DC 2000	DC 2000	DC 2000	DC 2000, DC 2080, DC 2120	DC 2000	DC 2000	DC 2000	DC 2110, DC 2165
40MB	42MB	40MB	83MB (152MB on DC 2120)	40MB	40MB	72MB	86MB (128MB on DC 2165)
■	❑	■	❑	■	■	❑	■
50	58	50	75	50	43	72	90

CONTINUES

have changed since the last backup.

Lacking in the *EzTape* software are any visible means of hinting how far your backup has progressed (or how close it is to completion). The system lists only the file being processed; other than on-screen messages, there is no indication when to change tapes.

Other difficulties included the inability of the 2080 to properly servo-write tapes; an error during a restore from the 2040; and when shuffling 40MB tapes during a large restore, the appearance of an additional command menu (rather than smooth progress) through the restore.

The first of these was probably a problem with the particular drive sent for evaluation. The second could not be explained by Irwin but could be conquered. To minimize problems such as our unrecoverable file, Irwin offers (but does not publicize) its own free data-recovery service and it claims the service has never failed to pull supposedly lost files from customers' tapes. The menu problem is slated to be fixed in the next *EzTape* update.

Over the years, the speed and quality of Irwin drives have improved dramatically. Once among the slowest available, they are now limited chiefly by the floppy-disk interface. Overhead is minimal in running the systems. If you don't mind the proprietary tape format, the 72 minutes it takes to format a 40MB cartridge (if you don't buy Irwin's 40MB or 80MB preformatted tapes at $35 or $36, respectively), and the do-it-yourself kit approach, you'll find the Irwin drives friendly and fast file-savers.

MOUNTAIN COMPUTER INC.

FileSafe TD4440
FileSafe 8000 Plus

by Catherine D. Miller

Mountain Computer's FileSafe tape backup units for PC-based hard disks run the gamut of capacities, from the DC 2000-based 40MB TD4000 Series to the Series 2100 helical-scan units, which are capable of backing up 2.2GB of data. Two of Mountain's DC 2000 offerings, the internal FileSafe TD4440, ($595) and the internal FileSafe 8000 Plus ($795), are reviewed here.

All of Mountain's backup systems use the same elegant and powerful *FileSafe*

DC 2000 TAPE DRIVES: SUMMARY OF FEATURES

(Products listed in ascending price order)

	Alloy Retriever/60 Alloy Computer Products Inc.	TG-1140 Tallgrass Technologies Corp.	ArchiveXL Model 5540 Archive Corp.	Excel 40AT Everex Systems Inc.	FileSafe TD4440 Mountain Computer Inc.
BACKUP SOFTWARE					
Disk space required	121K	236K	256K	512K	773K
Operation:					
Memory-resident operation	❑	■	❑	■	❑
Background or foreground operation	Foreground	Foreground	Foreground	Both	Foreground
Password protection	■	■	■	■	■
Volume label on tape	■	■	■	■	■
Backup and restore types:					
Image	❑	❑	❑	■	■
Modified image	❑	❑	❑	■	❑
DOS partition	■	❑	■	■	■
Backup and restore ranges allowed:					
Subdirectories	■	❑	■	■	■
Entire disks	■	■	■	■	■
Backup options:					
Append image backup	N/A	N/A	N/A	■	■
Maximum number of backup files	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited
Maximum number of backup directories	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited
Restore options:					
From file-by-file backup to any directory	■	❑	■	■	■
From image backup to any directory	N/A	N/A	N/A	■	■
DRIVE INTERFACE BOARD					
Connects in-line with disk controller	■	■	■	■	■
Uses board connecting in-line with disk controller	❑	■	❑	❑	❑
Uses standalone I/O board	❑	❑	❑	❑	❑

❑—Editor's Choice ■—Yes ❑—No

N/A—Not applicable: this product does not support image backups.

software. Version 5.03 can be accessed via menus or through the DOS command line. If you access the software through its full-featured menu system, you first use a moving bar menu to back up, restore, set defaults, or execute one of several utilities. You can erase a tape, format it, display its statistics, retension it, or rewind it. And you can verify the contents of a tape with a disk-and-view or print-tape directories.

FileSafe supports complete file-by-file backup and selective backup, which lets you tag any directory, subdirectory, or file to be written to tape. You can also determine whether you want to back up only files that have been modified since a specific date and time, files that have the archive attribute set, or only files time-stamped within a specified range. The flexible automatic backup option will back up your files at a specific time.

Mountain Computer's FileSafe tape backup software lets you create batch files to run several tape operations sequentially.

Although the *FileSafe* software supports image backup of disks 32MB and smaller under both DOS 3.3 and DOS 4.01, it can't back up a larger disk under DOS 4.01. Since you don't gain any speed by choosing an image backup, you'd be better off performing your backups on a file-by-file basis.

Restore options are just as bounteous as the backup options. You can also choose to redirect your restore operation to a different disk or directory.

If you opt to use the command line, you can create batch files to run several tape operations sequentially. Added flexibility is achieved by including response files—which can include lists of files to back up, restore, or verify—within your batch files. Most of the manual is devoted to the pro-

Tecmar QT-40i, Tecmar QT-40e Tecmar	**Bridge-Tape** Sysgen Inc.	**Irwin 2040** Irwin Product Group	**FileSafe 8000 Plus** Mountain Computer Inc.	**The Personal Archivist** Palindrome Corp.	**Irwin 2080** Irwin Product Group	**Reliant Model 510** Sysgen Inc.	**Data 123** Advanced Digital Information Corp.
512K	279K	512K	777K	1MB	512K	332K	512K
❑	❑	■	❑	❑	■	❑	❑
Foreground	Foreground	Both	Foreground	Foreground	Both	Foreground	Foreground
■ (Only with *SY-TOS* software)	❑	■	■	■	■	❑	■
■	■	■	■	■	■	■	❑
■	❑	❑	■	❑	❑	■	❑
❑	❑	❑	❑	❑	❑	❑	❑
■	■	❑	■	■	❑	■	❑
■	■	■	■	■	■	■	■
❑	■	■	■	■	■	■	■
■	N/A	N/A	■	N/A	N/A	■	N/A
25,000	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited
25,000	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited
■	■	■	■	■	■	■	■
❑	N/A	N/A	■	N/A	N/A	❑	N/A
■ (QT-40i only)	❑	■	■	■	■	❑	❑
❑	■	❑	❑	❑	❑	❑	❑
■	❑	❑	■	❑	❑	■	■

ENDS

PERFORMANCE TESTS: DC 2000 TAPE BACKUP DRIVES

DC 2000 tape backup drives have come a long way in reliability and in backup and restore speed. FileSafe 8000 Plus from Mountain Computer, an Editor's Choice, reached speeds averaging about 82K per second on the Full Disk Backup test. Everex's Excel 40AT—also an Editor's Choice—proved the fastest among the QIC-80–format drives we tested.

Elapsed Time (minutes and seconds)	Full Disk Backup	Full Disk Restore	Directory Backup	Directory Restore
The Personal Archivist	36:20	54:55	1:04	1:09
Alloy Retriever/60	26:00	33:41	0:35	0:26
TG-1140	25:30	21:45	0:42	0:19
Tecmar QT-40*	25:28	50:13	0:59	0:43
FileSafe TD4440	24:54	22:11	2:16	0:26
Irwin 2040	23:38	23:50	2:04	1:49
Reliant Model 510	23:32	21:31	0:30	0:16
ArchiveXL Model 5540	21:54	21:31	0:32	0:17
FileSafe 8000 Plus (QIC-80)**	20:25	20:12	0:58	0:29
Excel 40AT	20:21	19:45	0:18	0:14
Irwin 2080	20:06	20:35	2:16	2:01
Bridge-Tape	20:03	22:18	0:35	0:19
Data 128	13:30	16:26	0:12	0:20
FileSafe 8000 Plus (TD-101)**	8:55	13:36	0:44	0:15

In the **Full Disk Backup** test, the entire 43MB of the hard disk are backed up in file-by-file mode to the tape drive, simulating a first-time user's need to archive the complete contents of a hard disk.

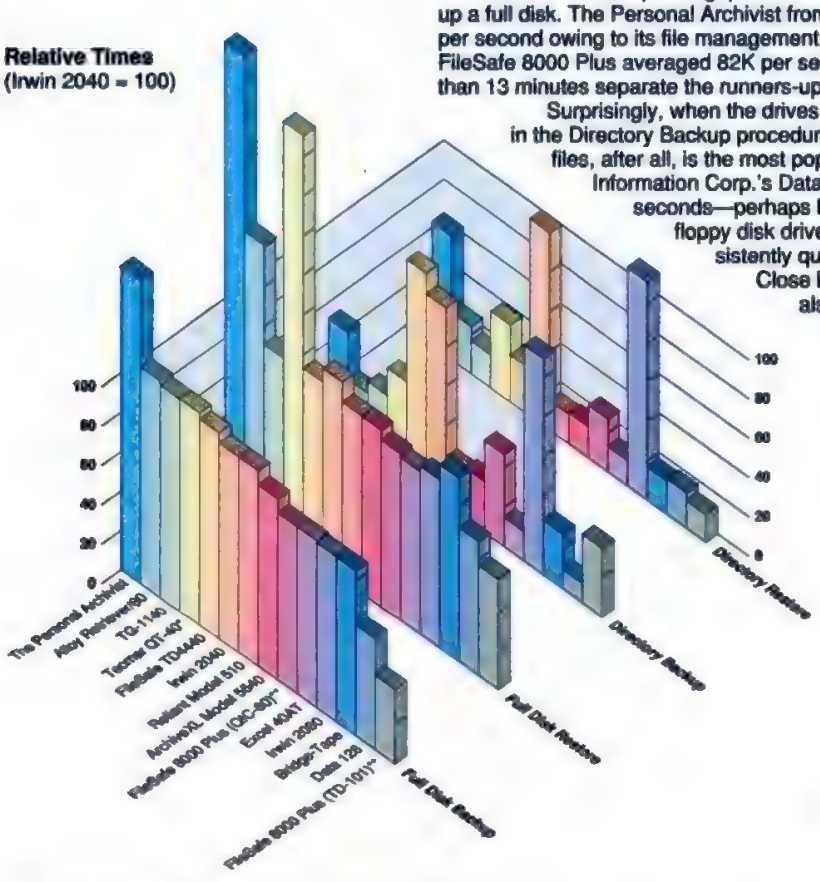
In the **Full Disk Restore** test, all data backed up during the Full Disk Backup test is restored to the hard disk over the existing directory; no reformatting is done. This represents one of several possible restore scenarios: reconstruction after a catastrophic hard disk crash.

For the **Directory Backup** test, a small subdirectory is selected and then backed up to simulate the type of activity that would normally occur during periodic selective backups, as opposed to the backup of an entire hard disk.

In the **Directory Restore** test, a small subdirectory is restored to the hard disk over the contents of a subdirectory with the same name. This reconstruction procedure illustrates one of several common restore situations.

PC Labs discovered quite a gap between the fastest and slowest tape drives in backing up a full disk. The Personal Archivist from Palindrome Corp. dragged along at roughly 20K per second owing to its file management procedures. By contrast, Mountain Computer's FileSafe 8000 Plus averaged 82K per second using its proprietary TD-101 format. Less than 13 minutes separate the runners-up on both sides of the speed spectrum.

Surprisingly, when the drives were given a smaller segment of data to back up in the Directory Backup procedure, their rank altered. (Selective backup of new files, after all, is the most popular form of routine backup.) Advanced Digital Information Corp.'s Data 128 flew through the task in a remarkable 12 seconds—perhaps because it used a SCSI adapter and avoided the floppy disk drive interface. This product provided the most consistently quick handling of large and small file segments. Close behind was Exerex Systems' Excel 40AT, which also scored well in both full and selective data backup.



* We tested the Tecmar QT-40i; the QT-40e is functionally identical.
** The FileSafe 8000 Plus tape drive was tested with tapes formatted to the QIC-80 and TD-101 standards.

PC Labs tested DC 2000 minicartridge tape backup drives on a 80386 computer running at a CPU speed of 16 MHz and a bus speed of 8 MHz. The object drive was a 60MB RLL device with an Adaptec controller. Our reviewers recorded times manually, beginning with the last keypress needed to start a procedure and ending with the return of keyboard control. Timers were stopped for tape changes and restarted when the process resumed.

The backup software for each drive was run with its default optimizations in effect. All tapes were low-level formatted and servo-written prior to backup and restore operations. The hard disk was low-level formatted before we installed each tape drive and DOS-formatted after each restore operation. We used DOS's CHKDSK to compare the original and restored byte counts.

The directory structure included several layers of subdirectories, including a hidden one. These subdirectories contained both small and large files, some of which were marked as system files or with the read-only attribute.

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CIRCLE 532 ON READER SERVICE CARD

Peter Norton on Paul Mace:

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—Peter Norton
The Hard Disk Companion, p. 338

"Thank you, Peter."

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CIRCLE 236 ON READER SERVICE CARD

FIFTH GENERATION SYSTEMS *The Creators of FastBack*

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gram's DOS command-line TAPE commands, and a quick reference guide is available if you forget the syntax.

FILESAFE TD4440

The drives belonging to the TD4000 Series follow the QIC-40 standard, offering 40MB of storage on a standard 205-foot DC 2000 minicartridge and 60MB on an extended-length 307-foot DC 2120 minicartridge. Mountain sells QIC-40 formatted DC 2000 tapes for $45 each.

The internal TD4440, which we tested for this review, carries a list price of $595. It attaches directly to a high-capacity floppy disk controller that has a data transfer rate of 500 kilobits per second; the TD4340, for $595, is designed to work with a standard floppy controller with a 250-kilobit-per-second data transfer rate. Either of these models occupies a half-height 5.25-inch drive bay. The TD4740, also $595, is a 3.5-inch version of the same drive designed for use in IBM PS/2 Models 50, 60, 70, and 80. The external TD4440 model sells for $745 without a power supply and for $899 with its own power supply.

The chassis for the TD4440 is made of a durable plastic. The TD4440 uses a direct-drive motor, with a helix-and-lever mechanism to raise and lower the brass read/write head. The drive writes 20 serpentine tracks, using an MFM recording mode with a density of 10,000 bits per inch. Most of the TD4440's circuitry relies on surface-mount technology.

Installation is simply a matter of plugging in a cable from your computer's power supply and attaching the cable for the B: drive to the TD4440's edge connector. A ground tab is included on the drive to connect with your computer's ground wire. An installation program, available in several languages, installs the software onto your hard disk and checks your hardware configuration to ensure that the TD4440 is connected properly.

The TD4440's results on our performance tests show that the speed of the floppy disk drive controller is the limiting factor in this drive's performance. A file-by-file backup of 43MB on a hard disk took nearly 25 minutes; restoring files to the disk took just over 22 minutes.

FILESAFE 8000 PLUS

The FileSafe 8000 Plus ($795 for the internal model), has the unique ability to record data in either of two formats: the standard QIC-80 format for 83MB or Mountain's proprietary MT101 format for 101MB of data on a high-density DC 2080 minicartridge. If you use a 307-foot DC 2120 minicartridge, you can store 124MB in QIC-80 format or 152MB in MT101 on a single cartridge. Since this drive doesn't use data compression to achieve this capacity, you don't have the overhead necessary to support compression or have to worry about errors being introduced.

The FileSafe 8000 Plus installs in a 3.5-inch drive bay. In contrast to the TD4440, the 8000 Plus has an aluminum chassis. The 8000 Plus uses a direct-drive motor, while a lead screw and guide pin are used to position the brass head to the tape, as opposed to the lever-and-helix method used in the TD4440. This mechanism allows for more-exact positioning of the head to the tape, doubling the capacity of the drive. The drive writes 28 serpentine tracks using the MFM recording mode. Although the drive will read QIC-40 standard DC 2000 tapes, it won't write to them. Both Mountain drives rely on the Reed-Solomon ECC (error correcting code) protocol.

If you choose to record in QIC-80 format only, the drive attaches directly to the floppy disk controller, and installation is the same as for the TD4440. If you choose to write data to tape in the MT101 format, you'll need to purchase Mountain's Mach^2 controller board. The 8000 Plus combined with the Mach^2 board list for $995. In both instances, the software verifies that all components of the system are functioning properly.

If capacity and backup speed are important to you, you'll find the 8000 Plus plus the Mach^2 controller board a winning combination. For one thing, the drive does the tape formatting while it is writing data to tape in MT101 format: you don't have to remember to prepare the tape before you use it.

Aside from convenience and time saved formatting, the 8000 Plus saves you time in other ways. This drive was the fastest in file-by-file backup and restore operations of any drive we tested, often by a significant margin. A file-by-file backup of 43.6MB took just under 9 minutes; restoring the same files to disk took slightly longer than 13.5 minutes. Quite impressive for a DC 2000 drive.

If you choose not to buy the Mach^2 controller, you'll find the data transfer rate to be limited by the floppy controller. A QIC-80 file-by-file backup of a 43.6MB disk took almost 20.5 minutes; restoring the same files to disk took just over 20 minutes.

Don't think you'll be giving up capability by choosing speed and capacity. When running the 8000 Plus with the Mach^2 while writing in QIC-80 format, the drive's performance improves drastically. And you can choose the best format for you through the software, without changing the hardware configuration.

Since Mountain sells through distributors, you can expect to pay 20 to 30 percent less than the list price for either of these units. Mountain also has several OEM agreements, so you may find Mountain-made drives with different labels.

Both the FileSafe TD4440 and the FileSafe 8000 Plus are top-quality minicartridge units that deserve attention. The 8000 Plus, with the Mach^2 controller board, is especially attractive because of its greater capacity, high-speed backup and recover rates, and its ability to format while writing data to tape.

FACT FILE
EDITOR'S CHOICE

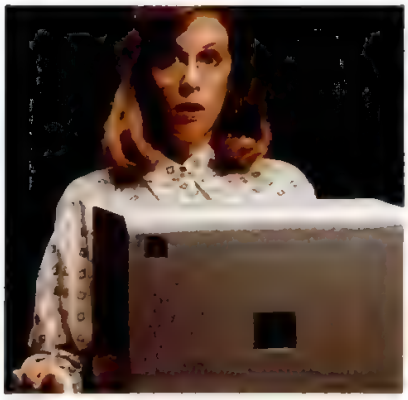
Mountain Computer Inc., 240 Hacienda Ave., Campbell, CA, 95008-6687; (800) 458-0300, (408) 379-4300.

FileSafe TD4440 (left)
List Price: TD4440 (internal), $595; TD4340 (external), $745
Requires: 384K RAM, one 5.25-inch half-height drive bay (for TD4440), DOS 2.10 or later.

CIRCLE 558 ON READER SERVICE CARD

▶FileSafe 8000 Plus (right)
List Price: $795 (internal); $995 (external); internal with Mach^2 controller card, $995; Mach^2 controller card, $250.
Requires: 384K RAM, 3.5-inch half-height drive bay (for internal model), DOS 2.10 or later.
In Short: The FileSafe TD4440 and the FileSafe 8000 Plus are well constructed and share the same powerful and flexible FileSafe software. The TD4440 performed well for a QIC-40 drive, limited only by the speed of the floppy controller. The 8000 Plus, when tested with its Mach^2 controller board, was the fastest drive we tested in backup and restore operations.

CIRCLE 601 ON READER SERVICE CARD

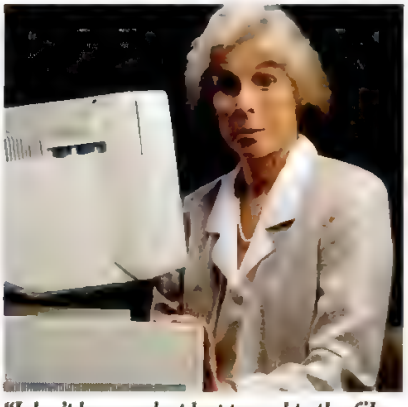


"Uh, my system crashed and my file disappeared."

"I'm sorry about those files but I'm sure there's hard copy around here somewhere."

"Someone must have been playing with my computer while I was out to lunch."

"My secretary spilled a cup of coffee on my desk and it ran over my disk."



"I don't know what happened to the files, they just disappeared."

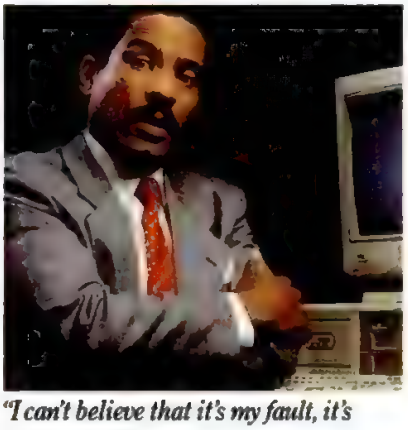
"Nobody told me that I was supposed to backup."

"My dog ate my data."

"I put the files on the floppy and then someone must have taken my disk."

"Well, it's a long story and I wouldn't want to bore you..."

"Have you ever had one of those days?"



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CIRCLE 219 ON READER SERVICE CARD

PALINDROME CORP.

The Personal Archivist

by Bruce Brown

Buying a tape drive seems like a logical step toward making backups easy enough that they'll actually get done. Unfortunately, the realities of maintaining an adequate number of backup files, making sure they're rotated properly, and handling off-site storage can be daunting. The Personal Archivist (TPA) from Palindrome Corp. goes beyond the other systems reviewed here by providing you with more than just hardware and software backup tools; it gives you a full tape backup management system.

For $795, the company bundles two components in its backup management system—the highly rated ArchiveXL internal tape drive (available separately for $500) and *TPA24*, Palindrome's own software ($295 separately).

The ArchiveXL 5540 offered by Palindrome is fully described in a separate review; briefly, it's a solidly built, internal 40MB QIC-40–standard drive. It fits in a 5.25-inch half-height drive bay and hooks up to your floppy disk drive controller. With its cast-aluminum base and direct-drive tape system, the Archive unit is built to last for a long time.

The Personal Archivist
Palindrome Corp., 710 E. Ogden Ave., #208, Naperville, IL 60563; (312) 357-4600.
List Price: $795; ArchiveXL Model 5540 alone, $500; software alone, $295.
Requires: IBM AT compatible with empty half-height drive bay, 512K RAM, 1MB free hard disk space, DOS 3.0 or later.
In Short: A standard Archive unit with Palindrome's own backup software, The Personal Archivist is initially slower than other products. But its purpose is to manage the entire backup process, including automatically tracking multiple backups and archiving inactive files; the result is less time spent with regular backups and less need for setting up and managing backups.

CIRCLE 602 ON READER SERVICE CARD

THE SOFTWARE DIFFERENCE

What makes the Palindrome system special, however, is the software. You need to allow approximately 1MB of hard disk drive space for *TPA24* to install its own programs, and to set up the extensive file catalogs that keep track of which tapes hold backups of which files. TPA requires you to start with enough tapes to back up all of your hard disk drive data three times over, plus two additional tapes. The program's working rule—which you can change—is that a file isn't adequately protected until there are copies of it on three different tapes.

TPA24 uses many rules for making decisions about managing the backup process. Other rules cover such questions as how often to back up files and when to *migrate* files—that is, erase files not recently used from your hard disk (as long as they have been sufficiently backed up). You can create special rules for individual files or types of files, such as backing up all *.WK1 files daily, or you can use the same rules for all files. Palindrome suggests that you abide by the default rules until your files are all protected and you fully understand the program, at which point you may change them to suit your tastes.

In addition to automatic archiving (letting the program tell you when it's time to make backups and which tapes to use), you can manually force backups with *TPA24*'s menu system. We ran our benchmark tests using the latter option. Because TPA spends a great deal of time managing the backup system, the benchmark times are slower than QIC-40 systems that use ordinary backup software. For example, although the actual format of your files is the same as that used by other QIC-40 systems, management overhead is increased because every time an individual file is backed up, a record of the time, date, and number of the backup is saved in TPA's own format.

Making the initial backup of our 43MB of data took over 36 minutes, and restoring that data took nearly 55 minutes—more than twice the time required by some of the simpler systems to restore the same amount of data. Even formatting a blank tape took longer than with most comparable systems: approximately 48 minutes compared with the more usual 44 minutes.

Fortunately, you only have to format all your tapes once. In addition, once TPA is in charge and has made ample copies of each file, subsequent backups will be much faster as the software avoids making unnecessary copies of files already adequately protected. Palindrome estimates that this translates into a savings of 50 to 80 percent of your normal backup time.

During the course of this review, Palindrome dropped the bundled price from $995 down to $795. But if the price still seems high, when you realize the value of full backup-management software—which tells you how to label your tapes, when to store them off-site, and even when to remove unused files from active drives—this system seems like a bargain indeed. Unless you or one of your employees is fully conversant with backup management strategies and able to faithfully implement them without additional help, the Palindrome TPA system can be a time and money saver.

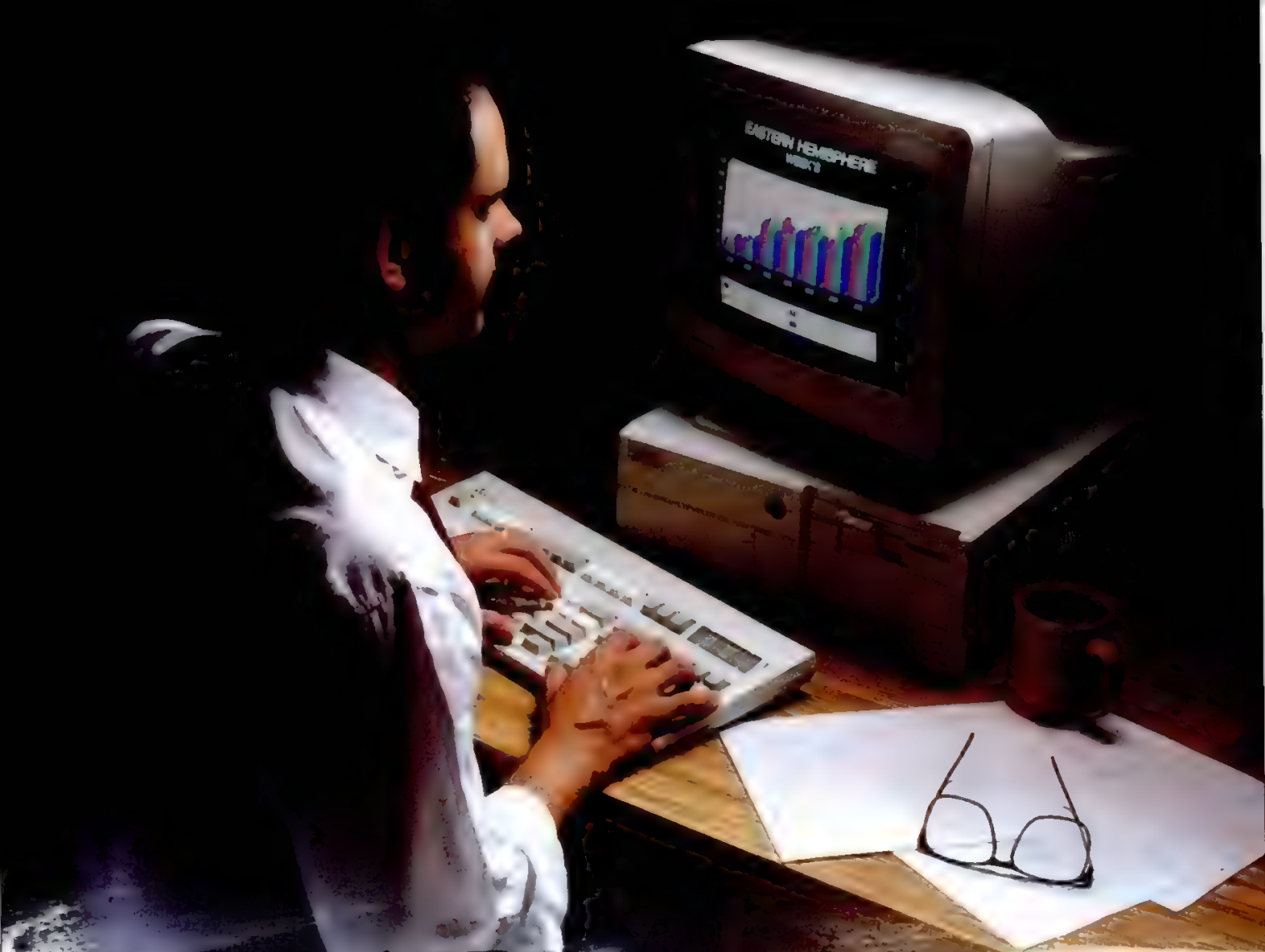
> Palindrome's The Personal Archivist goes beyond the other systems reviewed here—it's a full tape backup management system.

SYSGEN INC.

Bridge-Tape Reliant Model 510

by Catherine D. Miller

Sysgen is a relative newcomer to the tape backup market, having introduced its first tape drive product in late 1987. Yet Sysgen has demonstrated its commitment to the market with the two DC 2000 units reviewed here and a DC 600 product called the MAXI. Sysgen has also announced a tape drive based on a new technology that



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CIRCLE 368 ON READER SERVICE CARD

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Ms. Vickie Merkel
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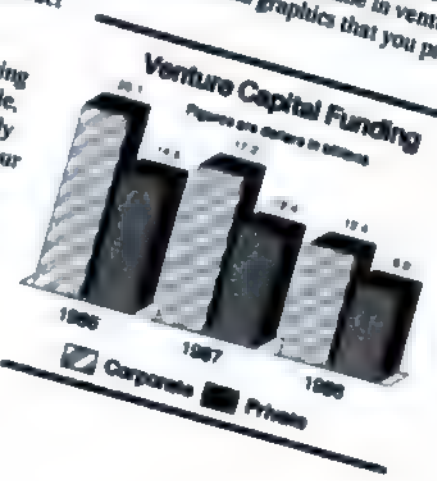
So please call me at your earliest convenience and we can meet to discuss the terms of your contract. Welcome aboard!

Sincerely,

William Reiser
Vice President
Research and Development

WR:tm



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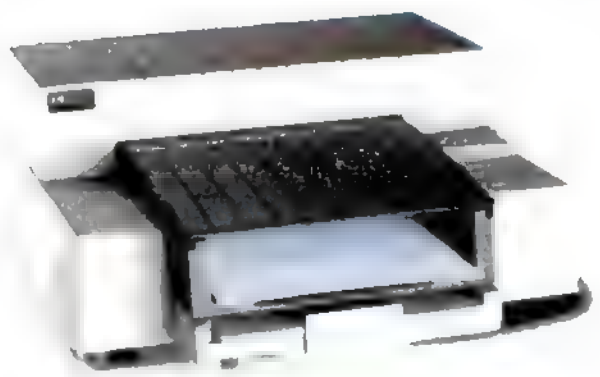

The $995* HP DeskJet PLUS printer.

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US vs. the dot matrix printer.

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HEWLETT PACKARD

CIRCLE 491 ON READER SERVICE CARD

allows random access to data stored on tape, letting the drive operate much like a standard disk drive.

The external Bridge-Tape ($695) has a 42MB capacity; a PSA 1030 adapter is an extra $70. Reliant Series 500 drives have a 72MB capacity; the internal Model 510 lists for $800, while the external Model 515 carries a list price of $1,000. The Reliant drives require a controller. The PT Kit ($195) includes a controller for the PC-standard bus; a controller for the Micro Channel bus is included in the $250 MTA kit.

The Bridge-Tape and Reliant drives have little in common other than that both are marketed by Sysgen. The Bridge-Tape drive and software are made by Colorado Memory Systems; the 8-bit adapter card included with the drive is manufactured by Sysgen. Conversely, both the internal and external versions of the Reliant are manufactured entirely by Sysgen.

BRIDGE-TAPE

The Bridge-Tape is an attractive and compact 2.2- by 6- by 10-inch (HWD) external unit with a capacity of just over 40MB, yet it is not QIC-40 compatible, as are most drives we reviewed with that capacity. It doesn't have the installed base enjoyed by the other non-QIC-40 drive with that capacity, Irwin's 2040, but the Bridge-Tape did turn in solid performances on our performance tests.

To install the Bridge-Tape unit, you must first install the adapter board. It must be installed in expansion slot number 6 or 7, so if you have other cards in these slots, you'll have to move them. The floppy disk interface cable plugs into the adapter board, and the cable that comes with the unit connects the adapter board to the floppy disk controller. Instructions for installation in several types of PCs, including the XT, AT, and PS/2 models 30, 50, 60, and

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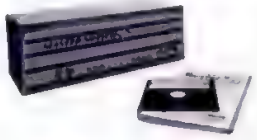

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CIRCLE 290 ON READER SERVICE CARD

FACT FILE

Sysgen Inc., 556 Gibralter Dr., Milpitas, CA, 95035, (800) 821-2151.

Bridge-Tape (left)
List Price: $695; with PSA 1030 adapter card, $765.
Requires: 256K RAM, DOS 2.1 or later.

CIRCLE 603 ON READER SERVICE CARD

Reliant Model 510 (right)
List Price: Reliant Model 510 (internal), $800; Reliant Model 515 (external), $1,000; PT Kit (AT bus controller card), $195; MTA Kit (Micro Channel bus controller card), $250.
Requires: 384K RAM, one 8-bit expansion slot, one half-height drive bay (for internal model 510), DOS 2.0 or later.
In Short: Sysgen's two products have little in common. An external backup unit with a 42MB capacity, the Bridge-Tape offers solid performance at a reasonable price. Its greatest limitation is its proprietary format. Masterminded by its own controller board, the 72MB Reliant gives good but not stellar performance. It follows the QIC-24 standard, a format commonly used for DC 600 drives.

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CIRCLE 745 ON READER SERVICE CARD

80, are clearly described in the manual.

The Bridge-Tape uses a direct-drive capstan motor. It writes data to tape at a density of 8,621 bits per inch in a 24-track proprietary serpentine format using MFM recording.

Before using a tape, you must format it in the drive in which it will be used: you can't buy preformatted tapes for this drive. If you attempt to use a tape that hasn't been formatted in the drive, you'll receive an error message that doesn't clearly state the nature of the problem. It took just over 51 minutes to format a tape, less than the estimated 55 minutes.

The well-designed and flexible Bridge-Tape software can be run via menus or from the command line, with all the program's options available in each mode of operation. Data on up to 90 tapes can be linked together via the software.

While Bridge-Tape doesn't support image backups, it does offer many file-by-file backup options. You can choose to back up all the files on a disk, tagged files, files in a specified directory, or only modified files. Performance on our Full Disk Backup test was better than most of the other systems, taking just over 20 minutes to back up a 43MB drive. It was the best performance of any drive that had to span two tapes to back up all the files.

The performance of Sysgen's Bridge-Tape on our Full Disk Backup test was the best of any drive that needed to span two tapes to back up all the files.

Restore options are just as robust as those for backup. You can restore files to any drive or directory and can tag files to be excluded from the restore operation. You can also choose to write to disk only those files that are not already on the disk. Restore times were less impressive than backup times, taking just over 22 minutes to restore the 43MB on tape.

You can set up a schedule for automatic, unattended backup, listing up to eight backup appointments. The automatic backup support is flexible, allowing you to do a selective backup at certain dates and times or on certain days of the week. You can also execute batch files with the unattended backup option.

Version 2.07 of the Bridge-Tape software supports DOS 4.01 but has a minor bug. When backing up files, you receive a message stating that DOS SHARE violations have occurred and that the files in question weren't backed up. Yet the files really have been backed up; when it's time to restore the files, they are on the tape and can be restored successfully. Sysgen was working with Colorado Memory Systems, the manufacturer of the software, to rectify the problem when this issue went to press.

RELIANT MODEL 510

The internal Reliant Model 510 evaluated here fits comfortably in a 3.5-inch drive

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bay. The Reliant's controller card, occupying an 8-bit expansion slot, connects directly to the drive via a 37-pin connector cable; several jumpers and switches on the board must be set. Although instructions for setting the switches are clearly presented in the manual, the jumper settings aren't referenced.

An installation program installs the program on your hard disk to the directory you specify. It also asks if your system has a real-time clock and whether you require automatic backup support. Without warning, the installation program alters your AUTOEXEC.BAT file to support the Reliant's operation.

The 72MB Reliant relies on a direct-drive capstan motor to move its brass read/write head. It writes data to tape at a density of 10,000 bits per inch in a 26-track serpentine QIC-24 format using GCR (Group Character Recording). This recording scheme allows the Reliant Model 510 to pack more data on standard DC 2000 tape.

One of the nicest features of the Reliant is its ability to format as it backs up, eliminating the need to spend additional time formatting or spend extra money for pre-

One of the Reliant's nicest features is its ability to format as it backs up, eliminating the need to spend time formatting blank tapes or buy preformatted tapes.

formatted tapes. No time was lost in backup and restore operations, but the times weren't as good as was hoped for in a drive with its own controller. It took about 23.5 minutes to back up 43MB of files, and 21.5 minutes to restore the files on tape back to the disk. Nearly 10 minutes of the backup operation were spent trying to find the end-of-tape data and rewinding the tape.

Some time was gained by performing image backup and restore. It took 18 minutes and 25 seconds to back up the same 43MB, and 18 minutes and 23 seconds to restore the same files to disk. However, you lose the ability to specify individual files by choosing to back up in image mode.

The full-featured Reliant software, Version 1.10, consists of three programs. IBACK supports image backup and restore operations, FBACK provids file-by-file operations, and TAPUTL includes tape utilities, batch file management, and automatic backup settings. While these programs will run either through a menu system or via command line, some features are available only from the command line. For example, you would have to use the command line to restore a group of files from tape to a different directory on-disk.

Backup options include the ability to append files. You can back up and restore files, specified groups of files, directories, subdirectories, or the entire disk. You can

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CIRCLE 519 ON READER SERVICE CARD

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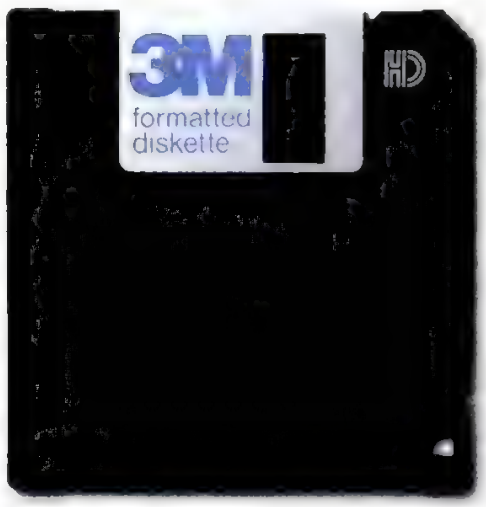

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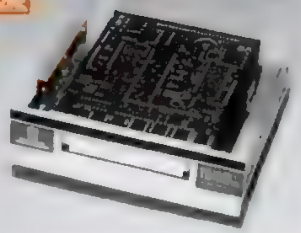
3M

choose whether to verify backup/restore or compare the tape with the disk.

Although CHKDSK indicated the disk was unchanged when the Reliant restored files from tape to disk, we were unable to boot the computer from the hard disk drive. Although we were able to access all the files on the disk, we were unable to copy the DOS system files to the disk so that it would be bootable. Apparently the restore operation altered the boot sector of the disk in such a way that it was unable to receive the DOS system files. Sysgen was aware of the problem and issued a corrected Version 1.2 of the Reliant software as this issue went to press.

Sysgen's technical support staff was helpful and knowledgeable about both drives, making it easy to work through the problems we encountered. Although a little on the expensive side, both the BridgeTape and Reliant were solid performers.

FACT FILE



TG-1140
Tallgrass Technologies Corp.
11100 West 82nd St., Lenexa, KS 66214; (800) TAL-GRAS, (913) 492-6002.

List Price: $495 (internal); adapter card, $95 (available in both PC/XT/AT and PS/2 versions); $179 for external conversion kit with adapter card, case, and cable.
Requires: 384K RAM, DOS 2.0 or later
In Short: The key word here is flexibility. The Tallgrass TG-1140 can function as an internal or external tape drive, connected directly to the floppy disk controller or by way of an adapter board, and in a classic PC AT system or in the MCA-bus PS/2. The features you need should be somewhere among these choices.

CIRCLE 605 ON READER SERVICE CARD

TALLGRASS TECHNOLOGIES CORP.

TG-1140

by M. David Stone

The TG-1140 from Tallgrass Technologies is nothing if not flexible. The system can function as an internal or external tape drive, connected either to the floppy disk controller or its adapter board, instead of or in addition to a B: drive, and in a classic PC/XT/AT system or in a Micro Channel architecture machine. In addition, you can use either DC 2000 40MB tapes or the new 60MB Carlisle DC 2000XL extended length tapes.

The TG-1140, priced at $495, is a QIC-40 internal unit based on a direct-drive motor. The drive connects to the floppy disk controller, but if you have a B: drive, a $95 adapter card allows the tape backup unit and floppy disk drive to coexist. A $179 upgrade kit, complete with the adapter card, case, and cable, lets you turn an internal unit into an external system. Tallgrass provided the internal drive and the PC/XT/AT upgrade kit; all tests were run with the drive installed as an internal device hooked to the floppy disk controller.

HARDWARE INSTALLATION

Hardware installation of the TG-1140 is simple. If you don't have a second floppy disk drive, just install the half-height tape drive in the B: drive bay and slip the drive B: connector onto the tape drive's edge connector. You then plug a power connector into the unit. If you do have a second floppy disk drive, unplug the drive cable from the floppy disk controller, plug it into the tape drive card, and connect a ribbon cable between that card and the disk controller.

To upgrade, install the drive in the 1.5- by 5.75- by 6-inch (HWD) external case, then plug the cable into the connector on the back of the adapter card. (According to Tallgrass, installation for the PS/2 version is similar, but it of course requires a different adapter card.)

The accompanying software is so easy to use that you probably won't need the manual unless you want to use the command-line mode for batch operation. When you start the program, the menu presents you with Backup, Restore, and Utilities options. (You can work only in file-by-file mode; image operations are not available.) Choose Backup and you get three options: Selective, Total, or Modified files only. Simply select the kind of backup, enter the drive to back up, a volume title and password (optional), and specify whether or not you'll use the compression feature.

We did not test the compression feature, but according to Tallgrass, it typically yields a 2 to 1 ratio. This translates to 80MB of hard disk files on a 40MB tape, or 120MB of files on a 60MB tape—but using the feature generally adds time to the backup.

RESTORE MENUS

The restore menus are also simple to understand and use. More importantly, the restore feature tries to save you from mistakes. If you set the software to overwrite files on disk, it warns you before starting the restore and waits for permission to continue. Even then, the software did not overwrite read-only files on our tests.

Performance times for the TG-1140 were well within the expected range: the backup time for 40MB was 25.5 minutes; restore time was 21.75 minutes. Backing up a single directory took a tolerable 42 seconds; restoring it, 19 seconds. Be aware that the software can restore only to the same path from which the files originally came, although it is possible to specify a different drive.

If you set the TG-1140's software to overwrite files on disk, it warns you before starting the restore and waits for permission to continue.

On PC Labs tests, the TG-1140 had trouble restoring files from some preformatted QIC-40 tapes (available from Tallgrass for $34.95). These problems disappeared after reformatting the tapes on the test unit.

The system took nearly 39 minutes to format a 40MB tape on an IBM AT—about 3 minutes longer than Tallgrass claims. On an XT or PC, Tallgrass claims a hefty 72-minute format time.

One problem with the TG-1140 was that it added some garbage at the end of the error log. Tallgrass claims to have fixed the problem in its current in-house version,

which was not yet at beta test level when this article went to press.

Overall, the TG-1140 is a solid backup system, which itself is backed up by a three-year warranty. And since the TG-1140 is easily adaptable to a variety of configurations, you won't have to worry about outgrowing your investment.

TECMAR

Tecmar QT-40i
Tecmar QT-40e

by Robert Kendall

Tecmar offers its 40MB tape backup unit in functionally identical internal and external versions. The $595 QT-40i internal unit fits an AT drive bay; and a PS/2 version is available for the same price. If you can't spare a drive bay but can part with more cash, you can opt for the $795 QT-40e external drive. This system requires Tecmar's $179 Floppy Tape Controller (add $20 for the Micro Channel version). Tecmar sells unformatted DC 2000 tapes for the units at a rate of two for $79.

For users with larger hard disks, the company also markets a complete line of high-capacity backup alternatives. Internal and external DC 600 tape drives with 60MB and 150MB capacities, 1.3GB DAT and 2.2GB helical-scan tape units round out Tecmar's backup product line.

INSTALLING THE QT-40i

You install the QT-40i just as you would a second floppy disk drive. If you already have two floppy disk drives and want to put the tape drive in a third bay, purchase the Floppy Tape Controller and connect the QT-40i to it with the vendor-supplied cable. (Tecmar provides a Y-cord for splicing into a power supply connection if you don't have one that's free.)

Even if you have no drive B: installed, you may want the controller card. Some features are available only if you run the backup software from a floppy disk (or a RAMdisk), and without the controller, you can't access the tape and floppy disk drive at the same time. The vendor also warns of possible incompatibilities if you run the tape drive from your system's floppy disk controller.

The QT-40e is a compact, sturdy external unit. This belt-driven drive connects to the Tecmar controller card and draws power from either Tecmar's optional External Power Supply or from your PC via an internal power supply connector plugged into the card.

Our QT-40i test system came with Tecmar's proprietary *QTOS* software, but the vendor will substitute Sytron's *SY-TOS* at the buyer's request. According to the company, *SY-TOS* is harder to use but offers extras like password security and the ability to back up non-DOS sectors.

QTOS provides a great deal of flexibility from an easy-to-use interface. You can do an image or file-by-file backup of an entire logical drive (but not more than one logical drive at a time). You can back up only files with the archive bit set or any specific directories and files you tag from an on-screen directory tree. The program lets you overwrite the current tape contents with each new backup or store each backup as a separate volume on the tape.

You can do a file-by-file restore of an entire volume or only tagged directories or files. You also have the option of renaming files and subdirectories to change their restore destinations. As a safety precaution, you may choose not to overwrite files that already exist on disk. During backups and restores, a progress screen displays elapsed time, estimates the time left, and lists any errors.

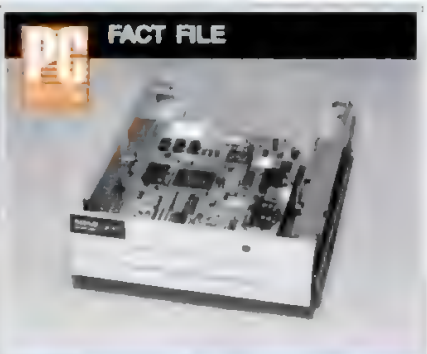
QTOS allows automatic backups at a specified time and date. It lets you initiate backups from a batch file and will even create the batch file for you. Other features include data integrity verification and network support. By the time you read this, data compression should also be available.

TESTING THE QT-40i

The QT-40i performed our tests accurately and had no trouble with hidden, system, or read-only files. During the full file-by-file backup test, it performed a little on the slow side, requiring about 25.5 minutes. It proved downright sluggish in restoring this data, taking over 50 minutes.

When the program ran from drive C: for the file-by-file backup and tried to back up the *QTOS* executable file, it caused a DOS error message, since the file was open for overlays. The only way around this is to exclude QT.EXE from the backup or run the program from the floppy disk drive (we took the second approach). The vendor says this problem arises from an incompatibility with DOS 4.01 and will be fixed in the next release. *QTOS*'s use of overlays also precludes it from restoring an image backup to the same disk from which the program is running, forcing us to load it from drive A: to do this test.

The package's out-of-date documenta-



FACT FILE

Tecmar
6225 Cochran Rd., Solon, OH 44139; (800) 624-8560, (216) 349-1009

QT-40i
List Price: $595 (choice of internal floppy drive connector or Tecmar Floppy Tape Controller card).
Requires: 512K RAM, hard disk drive, DOS 2.0 or later.

CIRCLE 606 ON READER SERVICE CARD

QT-40e
List Price: $795; Floppy Tape Controller, $179 ($199 for MCA version).
Requires: 512K RAM, Tecmar Floppy Tape Controller card, hard disk, DOS 2.0 or later.
In Short: These functionally identical internal and external drives from Tecmar don't provide exceptional speed, but they did prove reliable and flexible. Tecmar's proprietary *QTOS* software includes such features as data integrity verification and network support.

CIRCLE 607 ON READER SERVICE CARD

OUR CONTRIBUTORS

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Winn L. Rosch is a contributing editor of *PC Magazine* and the author of the book *The Winn Rosch Hardware Bible* (by Brady Books).
M. David Stone is a contributing editor of *PC Magazine* and an industry consultant who specializes in communications. ■

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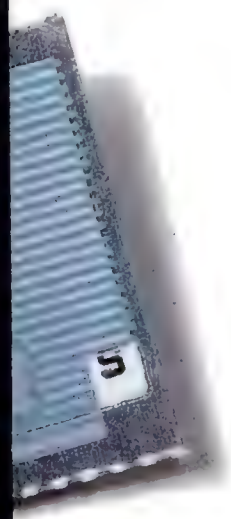

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CIRCLE 240 ON READER SERVICE CARD

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CIRCLE 378 ON READER SERVICE CARD

EDITOR'S CHOICE

- **Excel 40AT**
- **FileSafe 8000 Plus**

In our June 27, 1987, review of DC 2000 tape backup units, we found the products to be unreliable and slow. The drives we've reviewed here have improved considerably on both counts.

The speed of a drive that attaches to the floppy controller is limited by the speed of the controller itself, and those using their own controllers approach the speeds of DC 600 drives. The operation of nearly every drive we tested was trouble free (with the proper controller card) and all featured solid construction.

The $499 Everex Excel 40AT Floppy Tape System was the fastest QIC-40 drive we tested. Its robust software gives it an edge over other DC 2000 drives in its price and performance range—easing backup hassles for beginning and advanced users alike. Installation is a breeze, too. The system's only stumbling block is met during image backups of partitions larger than 32MB.

If speed and capacity are most important to you, Mountain's FileSafe 8000 Plus with its Mach^2 controller board ($995) was both the fastest during large backup/restore operations and the most flexible in terms of storage and format options. Mountain's *FileSafe* software continues to offer nearly every backup feature you would ever need. It also offers the ability to record data to tape in either of two formats: the standard QIC-80 format for 83MB, or Mountain's proprietary MT101 format for 101MB of data on a high-density DC 2080 minicartridge.

A special mention goes to the Tallgrass TG-1140 (and to maker Colorado Memory Systems) for its use of data compression to increase the capacity of a standard DC 2000 QIC-40 tape to 80MB and an extended-length tape to 120MB. Although backup and restore speeds are unexceptional, at $495 (and even better, $399 for Colorado Memory Systems' Jumbo 120), this is the best megabyte-per-dollar deal going.

tion was of no help in resolving these problems. The manuals don't even mention that the Tecmar controller will work with the QT-40i internal drive, much less that you must use it when you run the program from a floppy disk.

These problems aside, Tecmar's tape drives proved reliable and versatile. You won't get blinding speed, but the full-featured *QTOS* software and the Tecmar controller provide more flexibility than many competitors offer. ■

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POWER PAINTING ON A BUDGET

by Luisa Simone

Low-cost paint programs may not all support the higher-end hardware of the more sophisticated and more expensive packages, but they are catching up in other areas of functionality.

There's no denying that device independence and totally scalable drawings give vector-based graphics an edge in business applications. Still, there are times when nothing but a bitmapped picture will do.

True, bitmapped paint programs are constrained by the resolution and color capabilities of the display adapter, and yes, they do hog every available ounce of memory—but they remain the only way to create photographic images.

It is impossible to talk about paint programs without discussing the hardware they support. A VGA display with 16 simultaneous colors in high resolution (640 by 480 pixels) or 256 on-screen colors in low resolution (320 by 200 pixels) endows even inexpensive programs with the ability to create high-quality pictures. The programs reviewed here, *Deluxe Paint II*, *PC Paint*, *PC Paintbrush IV*, and *Splash!*, all list for just about $100. These take full advantage of the VGA standard by letting users choose on-screen colors from a hardware palette of over a quarter million hues.

Hardware support separates the low-cost programs from the high-end. As shown in the sidebar "The Graphics Adapter Link" the more-sophisticated programs deliver higher-quality images, in part because they support specific adapters.

Additionally, more-advanced programs like *VCN Concorde* support film recorders, and ZSoft's *PC Paintbrush Plus for Windows* takes advantage of expanded memory. (Significantly, Electronic Arts' *Deluxe Paint II* also supports EMS). This feature is important since because of memory constraints, many low-end paint programs restrict the image size to several hundred pixels of height and width. That translates to just a few square inches when printed out on a 300-dot-per-inch laser. Access to film recorders and the ability to use additional memory for larger images result in higher-quality output.

The good news is that many features of high-end paint programs are migrating down to low-cost packages. While the way they implement tool sets may be less sophisticated, the functions they can perform are nevertheless amazing. In fact, the perfect low-cost paint program—if it existed—would be an amalgam of the four products reviewed here, meeting every criterion listed in the summary of features.

Recent attention given to low-cost paint programs has focused on the search for ever more powerful tools. But unless you require specialized features—like the animation routines in Autodesk's *Animator* or Paul Mace's *GRASP*—these four programs will meet your needs.

More attention *should* be paid to how well low-end products address output issues. Creating an image in a paint program is just the first step; translating proprietary formats into industry standards like .PCX and TIFF, converting color screen images to black-and-white printer files, or creating screen shows complete the process.

Finally, by offering an easy-to-use interface, these programs benefit the occasional user who can invest only a few hours of learning time. The payoff is painting that is limited less by the constraints of the hardware or the tool sets of the software than by the clarity and colors of your imagination.

Deluxe Paint II

All reviews by Luisa Simone

Deluxe Paint II ($99.95 from Electronic Arts) doesn't just give you custom brushes, it gives you *power* brushes. The metaphorical brush is the only means to use patterns, or skew, rotate, and flip an image. Even resizing requires that you treat part of the painting as a brush and access the halve, double, or stretch menu functions.

User-defined brushes can be irregularly shaped and can access special modes like smooth, shade, or cycle. These features take advantage of the software's elegant custom palette. The program can compute the intervening hues between two end colors and keep track of four specified color ranges; these ranges serve to facilitate subtle color transitions for tools like shade or gradient fill.

Add to that 16 levels of magnification in which all the tools (geometric shapes, spray can, and paintbrushes) remain active, and you'll begin to understand the program's power. With that power comes a steeper learning curve. If you don't complete the tutorials, you'll never understand features like the three-dimensional brush that operates with true *x*, *y*, and *z* coordinates.

Creating patterns and defining brushes can make a big mess of your painting. To protect the image, the program furnishes an electronic scratchpad, stencils, and a feature that freezes the image as a backdrop, allowing you to keep your experi-

FACT FILE

Deluxe Paint II
Electronic Arts,
1820 Gateway Dr.,
San Mateo, CA 94404,
(800) 245-4525,
(415) 571-7171
List Price: $99.95
Requires: 640K RAM, DOS 2.1 or later, graphics adapter, mouse.
In Short: Expanded memory support and a wide range of powerful painting modes make *Deluxe Paint II* a superior program for creating pictures in VGA's high resolution. The fact that all of the painting tools and special effects remain active in the program's variable zoom mode make it an even better product for retouching your scanned images.

CIRCLE 416 ON READER SERVICE CARD

THE ART OF RETOUCHING

by Luisa Simone

To pose a real challenge for these bit-mapped paint programs, we created a 35mm slide of a teapot that contained rich colors, subtle shadings, and lots of reflections. But before we scanned the image, we damaged the slide to see if these under-$100 packages could adequately retouch the teapot.

Importing the teapot into our four programs required getting the image into the right video mode (256 colors and a resolution of 320 by 200), and into the programs' acceptable file formats (.GIF, .PCX, .LBM, and .SS). Both *Deluxe Paint II* and *Splash!* required using bundled screen-capture software to create a file in their proprietary formats.

The unique palette of the teapot image caused problems: colors used in the teapot image were picked up and used exclusively throughout the programs, resulting in illegible menus in one or two instances. You can expect to encounter the same difficulties if you scan images that contain close color values like pastels or very unsaturated colors.

The four programs, as you can see from the inset, all did tolerably well. However, *PC Paint*'s palette lets you see only 16 of the 256 colors at any given time. That plus the inability to pick up a color from the painting itself makes it almost impossible to choose precisely the right shade for retouching.

PC Paintbrush IV's eyedropper icon solves the problem of picking up colors from the painting (unless you are in zoom mode, where the eyedropper is not available). Its

Original damaged slide (notice the scratch)

special effects tools, though useful, suffer from the same problem: they are active only when you are in the full-image working view. *Splash!* ups the ante by using the F3 key to pick up colors from the canvas, even when in magnification mode.

Although *Deluxe Paint II* displays only 64 colors of the full 256 at one time, it is the only program that easily meets the challenge of retouching. It combines the ability to pick up color from the canvas—ensuring a good match to the surrounding area—with sophisticated effects like smoothing and airbrushing. These features remain active in zoom mode. ■

mental transformations on a totally reversible layer. Since these functions are memory intensive, it helps that *Deluxe Paint II* supports EMS.

Too bad that *Deluxe Paint II*'s excellent printer drivers do not compensate for the limited file-export functions. You must use an auxiliary utility to translate *Deluxe Paint*'s proprietary file format to a .PCX (EGA!) file.

Although Electronic Arts intends to continue marketing *Deluxe Paint II*, it is about to release *Deluxe Paint II Enhanced*, which will address some of these output problems. We hope that the newer product's screen-show utility will pop up in *Deluxe Paint II*; support for desktop presentations and film recorders would be the only changes needed to make this program's brushes so powerful that they'd sing as well as paint.

PC Paint

The most advanced features of the conventional tool set in Mouse Systems' *PC Paint*, Version 3.1—the filled curve and gradient flood—prove that sometimes a well-honed tool is more valuable than a hot new gadget. The unique gradient fill lets you determine the range of colors to use, as well as the direction in which the colors flow. But it is also smart enough to start the color cycle over when it encounters an internal line within a closed shape, in effect creating natural highlights on complex objects.

In other ways, this $99.95 program falls short. You cannot see all 256 colors (in MCGA mode) in one palette; instead

FACT FILE

***PC Paint*, Version 3.1**
Mouse Systems Corp., 47505 Seabridge Dr., Fremont, CA 94538; (415) 656-1117
List Price: $69.95
Requires: 512K RAM, DOS 2.0 or later, graphics adapter, mouse recommended.
In Short: *PC Paint* 3.1 supplies only the most basic painting tools, though they function well. For instance, the gradient fill can be used to create natural highlights on complex objects. The lack of any internal print drivers, as well as limited file export capabilites, require you to use a bundled auxiliary utility *(inset)* to produce paper output.

CIRCLE 417 ON READER SERVICE CARD

Retouched image from *Deluxe Paint II*

Retouched image from *PC Paint*

Retouched image from *Splash!*

Retouched image from *PC Paintbrush IV*

PHOTOGRAPHS: THOM O'CONNER

LOW-COST PAINT PROGRAMS: SUMMARY OF FEATURES

	Deluxe Paint II	PC Paint	PC Paintbrush IV	Splash!
List price	$99.95	$99.95	$99.95	$99.95
GRAPHICS ADAPTER SUPPORT				
Hercules	■	■	■	❑
CGA	■	■	■	❑
EGA	■	■	■	❑
VGA (640 x 480, 16 colors)	■	■	■	❑
VGA or MCGA (320 x 200, 256 colors*)	■	■	■	■
Highest resolution (pixels)	640 x 480	800 x 600	1,280 x 960	320 x 200
Number of simultaneous colors	16	4	2	256
AVAILABLE TOOLS				
Variable airbrush	280†	10	1,000†	7
Variable brush size	40†	30	100†	29
Curve tool	1	2	1	None
Straight lines	40†	3	800†	29
Primitives	8	10	8	4
Fill patterns	None	66	None	26
Roller and paint bucket	■	■	■	■
Freehand line	■	■	❑	❑
Eyedropper/pick-up color	■	❑	■	■
Tile/user-defined brush	■	■	■	■
Eraser	❑	■	■	■
Marquee	■	■	■	■
Free-form marquee	■	❑	■	❑
MANIPULATIONS				
Skew	■‡	❑	■	❑
Degree of rotation	1 degree ‡	90 degrees	1 degree	90 degrees
Mirror	■	❑	❑	■
Undo	■	■	■	■
Horizontal/vertical flip	■‡	■	■	■‡
Scale	■‡	■§	■	■‡
Copy/paste	■‡	■	■	■‡
Merge files	❑	■	❑	❑
Transparent background	■	■	■	■
Overlay/underlay	■	❑	❑	■
Rotate in 3-D	■‡	❑	❑	❑
Alternate workspace	■	❑	❑	■
SPECIAL EFFECTS				
Blend	■‡	❑	■	❑
Tint	❑	❑	■	❑
Smudge	■‡	❑	■	❑
Gradient fill	■	■	■	■

■—Yes ❑—No

* This is the maximum number of colors available at the lowest resolution.

† The software supplies only a small number of brush tips but a large number of brush sizes. The total number is arrived at by multiplying the two.

‡ This feature is available only as a custom brush or a stamp.

§ This feature is available only when copying image from clipboard.

‖ *Deluxe Paint II* does not read files directly; a conversion utility is supplied with the program.

LOW-COST PAINT PROGRAMS: SUMMARY OF FEATURES

	Deluxe Paint II	PC Paint	PC Paintbrush IV	Splash!
Antialiasing (smoothing)	■	❑	❑	❑
Contrast	❑	❑	■	❑
Brightness	❑	❑	■	❑
Color cycle	■	❑	❑	❑
Color range for fills	■	■	❑	■
Paint with shades	■	❑	❑	■
ZOOM CAPABILITIES				
Number of zoom levels	16	2	11	1
Full image available	■	❑	■	■
User-defined windows	❑	❑	■	❑
TEXT CAPABILITIES				
Number of vector fonts	None	None	4	None
Number of bitmapped fonts	21	28	20	13
Editing box	❑	❑	■	❑
Type enhancements (such as boldface)	■	■	■	❑
FILE FORMATS SUPPORTED				
.IMG (GEM)	❑	■	❑	❑
.PCX	■ II	■	■	❑
.PIC	❑	■	❑	❑
.TIF	❑	❑	■	■ (export only)
Other	.LBM (proprietary)	.GIF	None	.PCC; .SS (proprietary)
Can save user-defined palette in separate file	❑	❑	■	❑
OUTPUT DEVICES				
Epson graphics	■	❑	■	❑
HP LaserJet II	■	❑	■	■
HP PaintJet	■	❑	■	■
Apple LaserWriter (PostScript)	❑	❑	■	❑
MISCELLANEOUS				
Screen-capture utility	■	■	■	■
Screen-show utility	❑	■	❑	■
On-line help	❑	❑	■	■
Expanded memory support	■	❑	❑	❑
Keyboard equivalents (to replace menu and icon choices)	■	■	❑	❑

you must scroll through colors 16 shades at a time. The interface separates the 66 supplied fill patterns into three sets of 22 patterns each. I was continually searching for the right dithered color (a pattern that optically mixes two different colors to create a third hue).

Although the patterns are useful, you must spend a lot of time in magnify mode to come up with better optical mixtures. That's bad, because the fat-bit editing window has only two levels of magnification: too close and closer.

PC Paint writes .GIF, .PCX, and .IMG files. As is too often the case in the world of color graphics, the .PCX and .IMG formats caused problems when exported to desktop publishing programs.

PC Paint makes the issue of expanded memory support moot. I could create a larger-than-screen-size image in 640 by 480 resolution; at 800 by 600 pixels it was about three times larger than *PC Paintbrush IV*'s allowable picture size. Unfortunately, since *PC Paint* contains no print drivers of its own, the most you can do with the rest of the image is to scroll through it on-screen. Mouse Systems relies on a bundled version of *Inset* in order to print out a screen capture, and the extra part of the image is lost in the process.

PC Paintbrush IV

Special effects like smudge, blend, tint, and contrast in ZSoft's *PC Paintbrush IV*, Version 1.0, mimic more-sophisticated products such as ZSoft's own *Publisher*'s *Paintbrush* and *PC Paintbrush Plus for Windows*. But like most imitations, these

special effects don't quite live up to the quality of the originals.

Expect to spend some time experimenting with these tools to learn both their power and their limitations. However, even the crudest of these (the gradient fill) lets you block out an image in minutes. Then it's time to fine-tune the painting in the editing window. Eleven zoom levels and the ability to split the screen horizontally or vertically let you find the most comfortable working view for pixel editing.

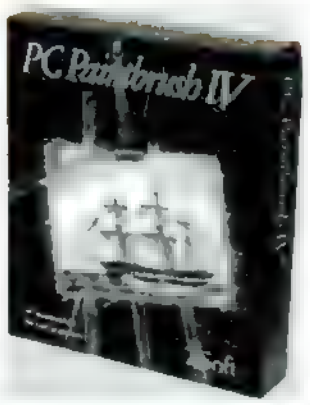
The $99.95 program offers intelligent text handling. While the marquee remains active, you can not only recolor, resize, or reposition the words you have typed, but also change the typeface, alter all of the enhancements—such as bold facing or outline—and even return to the dialog box to edit the copy itself. Desktop publishing aficionados will appreciate the inclusion of four outline fonts (which don't degrade as you increase the size), many specific printer drivers, and direct support of TIFF files.

In this robust program the clumsy custom-palette dialog box is disappointing. It lacks controls for automatically mixing transition colors and for specifying color ranges to be used in gradient fills.

SAA-compliant menus and on-line, context-sensitive help emphasize the program's ease of use, and the tool set promises power and flexibility. *PC Paintbrush IV*, however, makes some compromises. Because the lack of expanded memory support, coupled with a large .EXE file, left little RAM for the actual image, it consistently produced the smallest size files of the programs reviewed.

Despite these minor penalties, *PC Paintbrush IV* helps beginning painters create attractive art in the electronic world.

FACT FILE



PC Paintbrush IV,
Version 1.0
ZSoft, 450 Franklin Rd., #100, Marietta, GA 30067; (404) 428-0008
List Price: $99.95
Requires: 640K RAM, DOS 2.0 or later, graphics adapter, mouse.
In Short: Although *PC Paintbrush IV* isn't perfect—several of the special painting effects don't live up to the originals—it manages to deliver a broad range of painting tools, sophisticated type-handling features, and the ability to read and write TIFF files directly.

CIRCLE 416 ON READER SERVICE CARD

THE GRAPHICS ADAPTER LINK

The ability to have lots of color and high resolution depends in large part on the graphics adapter.

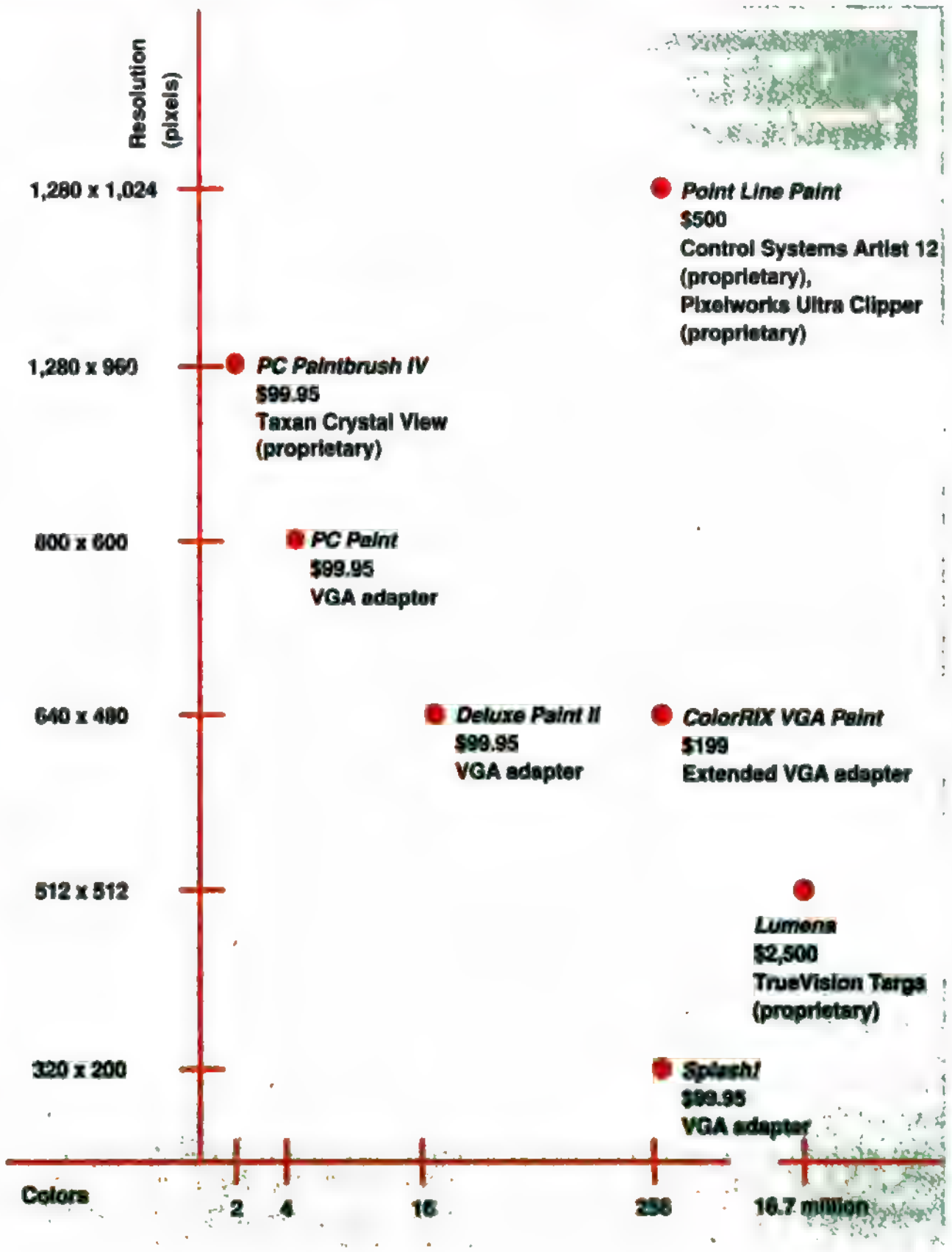
by Luisa Simone

A paint program's capabilities are linked to the graphics adapters it supports. This chart illustrates the relationship between the software and hardware.

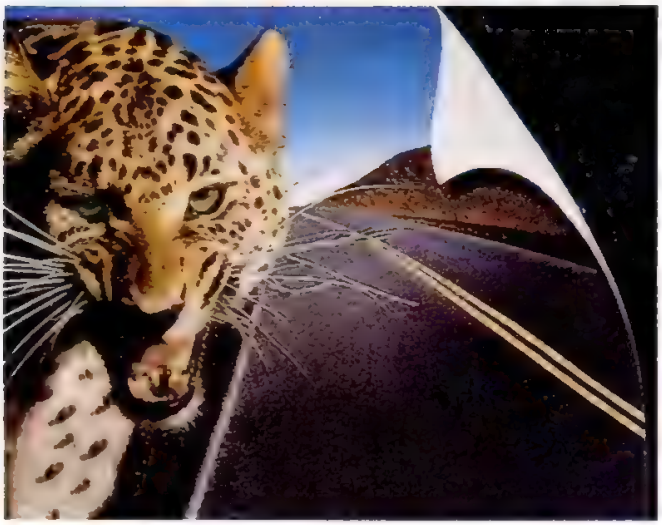
Each of the four programs we reviewed peaks at a different resolution. ***Splash!*** runs in only one video mode—320 by 200 pixels and 256 colors. ***Deluxe Paint II*** adds the standard VGA mode of 640 by 480 and 16 colors. Both ***PC Paint*** and ***PC Paintbrush IV*** give users the option of limiting colors and increasing resolution. The Taxan Crystal View adapter and monitor combination supported by *PC Paintbrush IV*, for example, displays very high resolutions useful in desktop publishing.

Though these low-cost programs maximize the VGA standard, none of them can deliver both high resolution and a large number of screen colors. More-sophisticated programs, like the $199 ***ColorRIX VGA Paint,*** wring more performance out of extended VGA adapters that have resolutions of 640 by 480 and 256 colors, or 800 by 600 and 16 colors. Application-specific programs, such as Robi Graphics' CAD-oriented ***Point Line Paint,*** support proprietary boards like the Control Systems Artist 12 or the Pixelworks Ultra Clipper, which can display 256 colors in 1,280 by 1,024 resolution.

Time Arts' ***Lumena*** and the TrueVision Targa graphics board it supports illustrate that the number of on-screen colors is as important as resolution in achieving photographic realism. At a mere 512 by 512 pixels, Targa adapters can display an amazing number of colors. In fact, with 16.7 million possible colors (using 24- or 32-bit color), the Targa board is capable of showing more hues than there are dots on the screen.



The Next Generation



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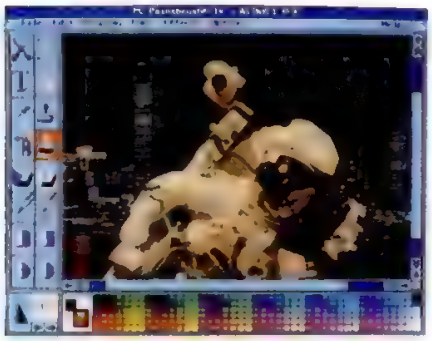

Enhance any part of an image: Change tints. Lighten, darken, blur or adjust contrast. And blend new elements with existing background.

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The power to enhance.

PC Paintbrush IV is perfect for retouching less-than-perfect images. Adjust any image's size . . . tilt it or flip it . . .enhance or remove any part of an image . . . or use the gray-scale editing features for continuous-tone images. It's like having a photo lab in your computer!

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Image editing can be done in zoom-in mode on an adjustable split screen.

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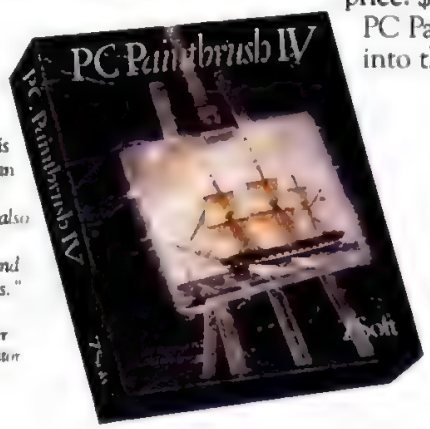
Get all the power you need. Get PC Paintbrush IV. It's the master's touch at a miser's price: $99.95. Move up to PC Paintbrush IV. And move into the next generation.



"PC Paintbrush IV is destined to become an important tool, not only for artists, but also for people who use desktop publishing and presentation graphics."

Michael Miller
Executive Editor
InfoWorld
5/1/89

ZSoft
CORPORATION

450 Franklin Road / Suite 100
Marietta, Georgia 30067
(404) 428-0008
FAX: (404) 427-1150
Telex: 6502859318

640KB RAM required. Image size severely limited by available DOS memory.

PC Paintbrush IV is a trademark of ZSoft Corporation

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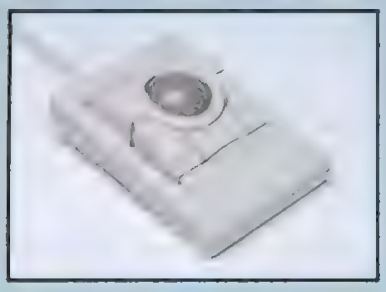
CIRCLE 744 ON READER SERVICE CARD

NEW!

When a mouse doesn't solve your computer interface needs then Mouse Systems' PC Trackball is the answer.



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CIRCLE 120 ON READER SERVICE CARD

Splash!

Spinnaker Software's *Splash!* ($99.95) sparkles when used to manipulate or retouch scanned images. Its overlay/underlay options and alternate workpage come in handy: special painting modes let you erase the colors from the top canvas and reveal those of the alternate page beneath.

You get direct control of the palette. If you want a range of colors, click on the starting color and drag your mouse to the end color. A pop-up menu asks if you want to paint with the new range, blend the range to create transition colors between end points, or convert it to shades of gray.

Splash!, however, supports only the VGA/MCGA standard of 256 simultaneous colors and a 320 by 200 resolution—and that's all. The lack of 640 by 480 resolution ties your hands when creating an image from scratch. The tool set imposes limits on brush sizes and shapes, and the pop-up window for fat-bit editing cannot be moved or customized.

Because the screen layout uses the same physical location for the pattern menu, the color palette, and the brush icons, you must wait for the screen to redraw the various menus every time you want a different tool.

Unless you own a ComputerEyes video capture board, which supports *Splash!*'s proprietary format, you must use the program's screen capture utility to import images. This inability to read standard formats doesn't keep *Splash!* from exporting *PC Paintbrush* and TIFF files. Although the *PC Paintbrush* option does not produce a true .PCX file, *PageMaker* had no problems importing or printing the .PCC image. The .PCC and TIFF files imported into *PageMaker* actually produced the best-quality printouts.

Splash!'s interface is nearly all icon-based. Only a few menus—for saving files or choosing brush sizes—are necessary. Anyone who enjoys computer painting will find the artist's tools in *Splash!* too limited, but for retouching, resizing, and exporting scanned images, buy *Splash!* and dive in. ■

Luisa Simone is a contributing editor of PC Magazine.

FACT FILE

Splash!
Spinnaker Software Corp., One Kendall Sq., Cambridge, MA 02139; (800) 826-0706, (617) 494-1200
List Price: $99.95
Requires: 512K RAM, DOS 2.1 or later, graphics adapter, mouse.
In Short: The only video mode that *Splash!* supports—MCGA/VGA 320 by 200 resolution and 256 simultaneous screen colors—is more suited to retouching scanned images than to creating paintings from scratch. But praise goes to its totally icon-based interface and to the extremely high-quality TIFF files it exports.

CIRCLE 419 ON READER SERVICE CARD

EDITOR'S CHOICE

No mix just right

PC Paintbrush IV, *Deluxe Paint II*, *Splash!*, and—to a lesser extent—*PC Paint* prove that low-cost paint programs can be as powerful as the more expensive products. They also prove that they can be equally flawed. The perfect low-cost paint program would consist of *Deluxe Paint II*'s tool set, the outline fonts and text-handling abilities of *PC Paintbrush IV*, and *Splash!*'s superior-quality TIFF and .PCC file exports.

Deluxe Paint II is best for desktop presentations. Using the screen as the output device shows its superior custom brushes and special effects to their best advantage; it also minimizes the inadequate import and export functions of the program.

If you use scanned images exclusively and plan to bring files into your desktop publishing program, buy *Splash!* The icon-based interface guarantees that you won't have to read the manual, and you won't have to worry about the quality of the exported images.

Although its tools aren't as elegant as those in *Deluxe Paint II* and its TIFF files aren't as good as *Splash!*'s, *PC Paintbrush IV* is the only program reviewed that combines both capabilities. If you need access to outline fonts and can take advantage of the higher resolutions that *PC Paintbrush* offers through its support of proprietary video adapters, this is the product for you.

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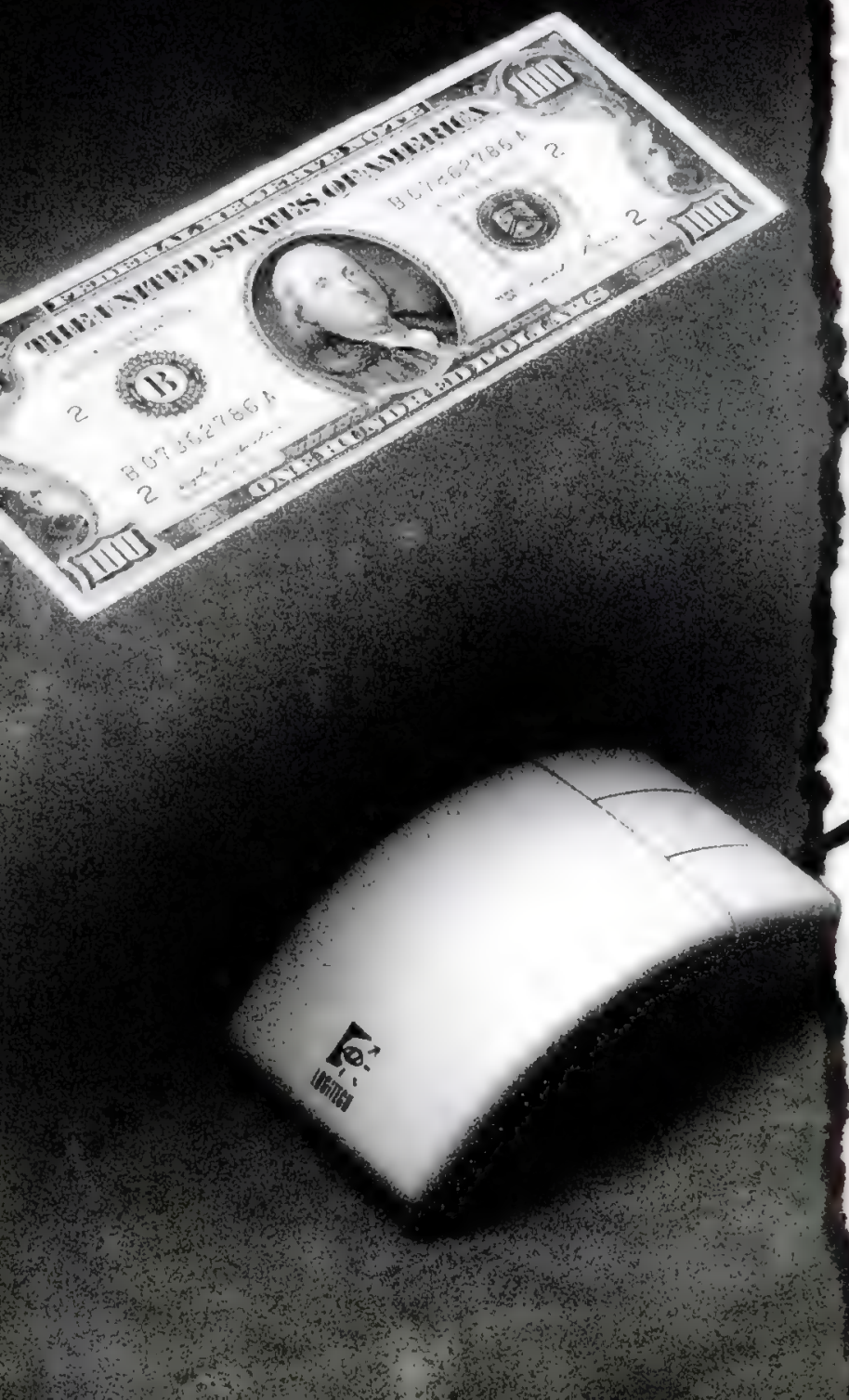

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by
Douglas Boling
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Utilities

Give Yourself a Smart DOS Command Line with ALIAS

How many times do you wish you could edit the DOS command line instead of retyping it? Or recall rather than reenter commands you've issued previously? Or use an abbreviation or a function key in place of a frequently used command or a long path string?

That's how many times you'll be glad to have our ALIAS utility.

ALIAS's editing facilities give you a word processor's control over the DOS command line. You can move the cursor by character, by word, or directly to the end of the command line; deletions can be made in this same manner. You can also insert or overstrike characters on the command line, and when you toggle into insert mode, the cursor changes from an underscore to a block.

ALIAS keeps track of the last 16 commands you've issued and lets you pop them onto the command line without retyping. You can make the command stack even larger, if you like. To make retrieving a previously issued command easier, ALIAS incorporates a smart search feature that helps you quickly locate a command on the stack by looking for a character pattern that matches the one you type in. And to avoid cluttering the stack with short two- or three-letter commands like CD and DIR, you can set the minimum command length that ALIAS will remember.

The feature that gives ALIAS its name was borrowed from UNIX. By assigning *aliases*—essentially command synonyms—you can abbreviate long commands or even create new commands from a combination of other commands and command-line parameters. An alias can be as simple as shortening TYPE to TY. A more complex example might involve assigning ("aliasing") the name WHEREIS to the command string

```
CHKDSK /V | FIND "$1"
```

This creates a command that will find a file when you enter WHEREIS *filename* at the DOS prompt. Again, if you can't remember all the command switches needed to format a 720K floppy disk in a 1.44MB drive, you could make FMT720 an alias for the command string

■ Now you can edit the command line, reissue previously typed commands, and abbreviate long command strings to simplify working with the DOS interface.

```
FORMAT $1 /T:80 /N:9
```

And to make the aliasing feature even more powerful, aliased commands can incorporate environment variables located in the DOS environment block.

ALIAS also lets you assign frequently used commands and command strings directly to function keys F1 through F10 and to all of their Shift-, Ctrl-, and Alt- combinations. Depending on how you choose to set them up, commands assigned to the function keys will be executed either immediately or only after you press Enter.

The easiest way to obtain a copy of ALIAS.COM is to download it in ready-to-run form from PC MagNet, as explained in the sidebar "ALIAS by Modem." ALIAS.ASM, the assembly language source code, and ALIAS.BAS, the BASIC listing, can also be downloaded. Because of space limitations, we are unable to print the source code here. But you can get a copy of the assembly or BASIC listings by mail or fax by sending a written request with your name, address, and fax number (if applicable) to *PC Magazine*, Utilities, One Park Avenue, New York, NY 10016; Attention: Carolyn Falconer. (Note: estimated fax length is 45 pages.) No phone calls please.

A TEST DRIVE

After downloading ALIAS, you may wish to take ALIAS for a quick test drive even before you examine its full syntax and options. To do so, just enter ALIAS at the command line and issue a few commands of your choice. When you now press the Up and Down Arrow keys a few times you'll see how you can browse backward and forward through the command stack. Type in (without hitting Enter) a long command, such as

```
RENAME Z:NOFILE.DOC ANYFILE.DOC
```

and use the left and right cursor keys to move the cursor around. To move a word at a time, use Ctrl–Left Arrow and Ctrl–Right Arrow; Home and End take you directly to the beginning and end of the command line.

To erase text from your command line, use the Del or Backspace key on characters, Ctrl-Backspace to delete the word at the cursor, and Ctrl-End to delete everything from the cursor to the end of the line.

To enter new characters, just position the cursor and start typing. By default, ALIAS works in overstrike mode, but the Ins key will toggle insert mode on and off. To blank the command line and return to the bottom of the command stack, press Esc. A complete list of all the editing and command-recall keystrokes used with ALIAS is tabulated in Figure 1.

To invoke ALIAS's smart search feature, type the first one or two letters of a command you typed previously and press Up Arrow. As you move forward and backward in the command stack, using the Up and Down Arrow keys, ALIAS will now present only commands that match this pattern. Suppose, for example, that somewhere on the command stack, you have the command

```
CD \WP\DOCUMENTS\PERSONAL\YEAR89
```

which you want to recall and reexecute. If that command is buried a dozen or more commands deep, it will take a good many Up Arrow keypresses to get to it—unless you use smart search. To do so, type CD before hitting Up Arrow, and ALIAS will take you directly to it. (If there's an intervening CD command on the stack you'll hit that first, of course, but you can either use a longer search string or accept the need for a few Up Arrow keypresses.)

To see the aliasing feature at work, try entering `ALIAS D DIR`. When you now type D and hit Enter, you'll get a directory listing, for D is now a synonym (alias) for DIR. To erase the assignment, enter `ALIAS D`—that is, the alias with nothing to be assigned to it.

Now enter `ALIAS [F1]* CLS`. Then press function key F1. This will clear the screen: the asterisk following [F1] on the command line tells ALIAS to execute the command as soon as F1 is pressed. If you omit the asterisk, the CLS will be typed, but the command won't be executed until you press Enter.

For a more sophisticated example of what ALIAS can do, enter

```
ALIAS [AF10] PATH $PATH%;
```

If you now press Alt-F10, your current DOS path (extracted from the set of environment strings DOS maintains in memory) will be shown, preceded by a PATH command, with the cursor positioned at the end of the line, so you can append a new directory name to the path string. (Be sure to precede the new entry with the semicolon PATH statements require between items.) The `[AF10]` tells ALIAS to assign the command that followed it to function key Alt-F10; the `PATH %PATH%` tells it to type the word PATH, followed by the actual PATH environment string (sandwiched between percent signs).

An alternative to assigning the command to Alt-F10 would be simply to create a new command not tied to any function key. Try

```
ALIAS APATH PATH $PATH%;
```

Then type APATH followed by the new entry to modify the current path. Appending a new entry to a long path string will no longer be the time-consuming task it used to be.

USING ALIAS

The syntax for ALIAS is

```
ALIAS [?][/U][/D][/E][/L]
[/F [d:][path]filename][/B nn]
[/M nn][/S nn][alias [command]]
```

Don't be intimidated by the large number of optional command-line parameters! Not only has the section above already familiarized you with ALIAS's editing keys, but they're also summarized in Figure 1. As you've also seen, entering ALIAS by itself on the command line installs the program in memory (it's a TSR) with its defaults. When in doubt, entering ALIAS ? will bring up an explanatory help screen.

Similarly, after installation, running ALIAS /L will display a list of current aliases and function-key definitions, along with all other important parameters.

Three of ALIAS's optional switches can be entered only when the program is initially installed, as they affect the amount of memory it must set aside before becoming resident. If you expect to use certain alias assignments regularly, you can create a command file (described below) that contains them. You then use the /F switch at installation time to specify the command filename (and its location, if necessary) that ALIAS should load.

The /B *nn* and /S *nn* switches, if used, must also be entered when ALIAS is loaded. ALIAS initially reserves a default buffer of 512 bytes for alias strings you may wish to enter. The /B *nn* switch allows the size (*nn*) of this buffer to be changed at installation time. If you load ALIAS with /B 0, for example, you'll save memory, but you'll have to delete alias strings from a command file loaded with /F before you can add any new aliases.

Similarly, by default, ALIAS reserves memory for a command stack of 16 commands. If you wish to use a different size command stack (each entry on the stack uses 128 bytes of memory), the /S switch allows you to specify the number (*nn*) of commands you want ALIAS to remember. A stack size of zero disables the command stack completely. Again, trying to change the stack size after the fact will produce the error message "Can't change parameter after installation."

Since the command stack is meant to save you from having to retype long commands, it's annoying if it fills up with short three- and four-letter commands that are faster to type than to find. By default, ALIAS stacks every command except null commands, regardless of length. The /M *nn* switch lets you specify a minimum

ALIAS COMMAND-LINE EDITING KEYS

CURSOR MOVEMENT	
Home	Go to beginning of command line
End	Go to end of command line
Left Arrow	Move one character left
Right Arrow	Move one character right
Ctrl-Left	Move one word left
Ctrl-Right	Move one word right
TEXT INSERTION AND DELETION	
Esc	Erase command line
Ctrl-End	Delete from cursor to end of line
Ctrl-Backspace	Delete word at the cursor
Backspace	Delete character left of the cursor
Del	Delete character at the cursor
Ins	Toggle insert mode on and off
COMMAND RECALL	
Up Arrow	Recall previous command
Down Arrow	Recall next command

Figure 1: ALIAS provides command-line editing functions for nondestructive cursor movement, text insertion and deletion, and recall of previously issued command lines. The recall keys let you limit the command-stack search to commands that match a pattern you type in.

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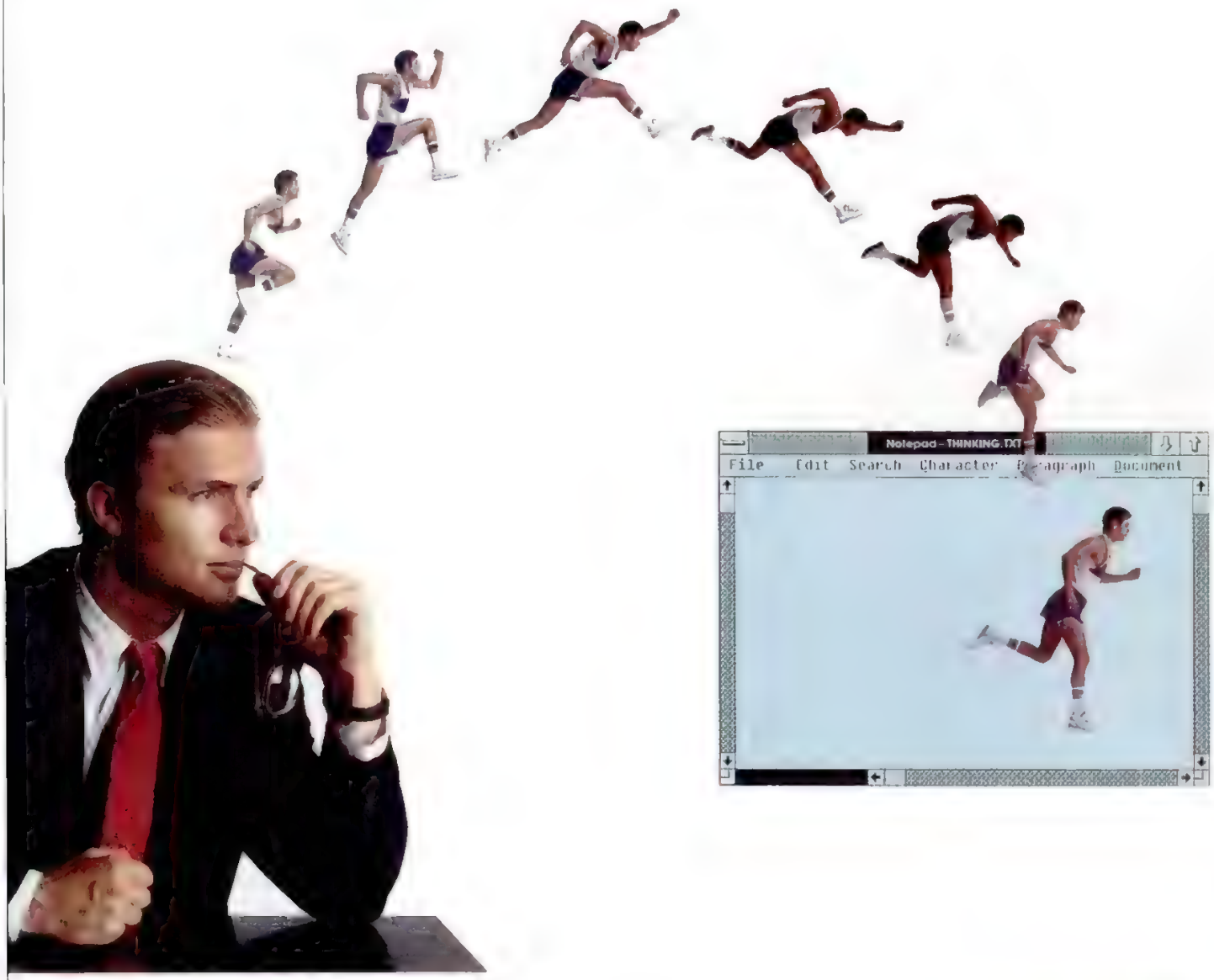

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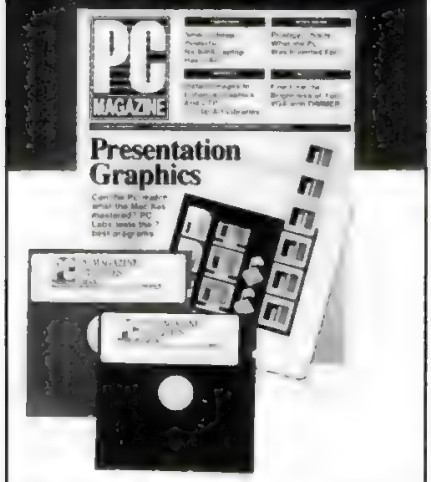

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length (*nn*) for commands that will be saved on the stack. For example, after you enter ALIAS /M 4, ALIAS will not stack commands of three characters or less. You can change the minimum stacked length at any time by rerunning ALIAS with a new /M *nn* switch.

The syntax for creating an alias is

```
ALIAS alias [command]
```

The *alias* variable here can be any one-word alphanumeric string; *command* can be a string consisting of any number of words terminated by a carriage return. Note that since ALIAS assumes that any string after the *alias* variable is part of the *command*, you can't include the usual ALIAS command switches when you're actually creating an alias definition. Note, too, that if you omit the *command* portion of the assignment, ALIAS will delete anything previously assigned to the *alias* string.

As indicated earlier, aliases are handy for shortening or renaming frequently used commands. For example, you could abbreviate the command TYPE to TY by entering `ALIAS TY TYPE`. Thereafter, entering `TY FOO.FIL` will do the same thing as `TYPE FOO.FIL`. You could, of course, create a similar TY command with a batch file, but using ALIAS eliminates the time it takes for DOS to read the .BAT file from disk and process it.

One feature ALIAS borrows from batch files is the ability to make use of replaceable command-line parameters. Replaceable parameters come in handy if you want to use parts of a command line more than once. For example, after defining BACK as an alias by entering

```
ALIAS BACK COPY %1.ASM %1.BAK
```

you can simply enter `BACK FILE1` to copy FILE1.ASM to FILE1.BAK. If a command line parameter is included in an alias, ALIAS will not append the remainder of the command line after the alias has been translated.

Another feature that adds to what you can do with ALIAS is its ability to use environment variables. Environment variables allow aliases to be written for generic tasks with the specific target of the alias specified in the environment block rather than in the alias itself. For example, to set up an alias to use *WordPerfect* to edit a file named in the environment variable WORKFILE, you would enter

```
ALIAS EDIT WP %WORKFILE%
```

You would, of course, have to have established the contents of WORKFILE with a SET command, such as

```
SET WORKFILE=LETTER.DOC
```

The contents of the variable will be substituted for %WORKFILE% when the alias is translated. Note that environment variables used in ALIAS commands must be delimited by percent signs.

ALIAS determines the difference between a normal command-line parameter and an environment variable by examining the first character *following* the percent sign. If the character is a number, ALIAS assumes it is a replaceable command-line parameter, not an environment variable. As a result, ALIAS will not recognize environment variables that begin with numbers.

Using ALIAS instead of batch files eliminates the time DOS takes to read the file from disk and process it.

Assigning commands to function keys is even simpler. To assign CLS to function key F1, you'd enter `ALIAS [F1] CLS`. To cause immediate command execution when the function-key is pressed, put an asterisk after the closing bracket in the string that denotes the function key, for example, `ALIAS [F1]* CLS`. Environment variables can be used in function-key definitions the same way they are in command definitions.

ALIAS also supports function-key assignments using the Shift, Ctrl, and Alt keys, giving you 40 function key combinations in all. (DOS does not support function keys F11 and F12, so ALIAS cannot support them either.) To assign the CLS command to Alt-F3, you would enter

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`ALIAS [AF3] CLS`. The Ctrl-F3 and Shift-F3 combinations would be specified using [CF3] and [SF3] strings, respectively.

You can remove a function-key assignment just as you remove a conventional alias: by leaving off the command assignment. In the example just cited, Alt-F3 would be restored to normal operation with the command `ALIAS [AF3]`.

As indicated earlier, if you have a number of alias assignments you want to use regularly, you should specify a command file with the /F switch when you first load ALIAS. The command file is a simple ASCII text file that can be up to 32K. A sample command file is shown in Figure 2.

By using a command file you can create some otherwise unobtainable alias assignments. For example, if you entered

```
ALIAS TY TYPE %1 | MORE
```

on the command line, the `| MORE` will be ignored. This is because DOS filters out any redirection commands entered on the command line. The solution is to enter the same ALIAS command in a command file. There, any commands—even those that contain |, <, and > symbols—will work just as you intended them to.

All of the command-line switches defined for the command line can also be used in the command file. You could even call one file from another with the /F switch. Note, however, that if you do this, once the new command file has been loaded, ALIAS will not return to finish parsing the old one! If you should wish to call one file from another, then make sure it's done on the last line of the first file.

To make command files more readable, comments can be included following /* or // delimiters; ALIAS ignores the remainder of the line when it encounters either of these delimiters. Other switches can be included on the same line as long as they precede the comment switch. Blank lines are ignored.

When using ALIAS there may be times when you don't want a defined alias to be implemented. There are two ways to short-circuit the translation. The first is temporarily to disable ALIAS by executing it with the /D switch. The command-line editor and command-stack features of ALIAS will still work, but no alias translation will occur. Entering ALIAS with the /E switch will reenable normal translation. To avoid an alias translation for just one command, insert a space at the beginning of the command. ALIAS will not translate a command that begins with a space.

To help you keep track of all the active aliases, ALIAS provides the /L switch. Invoking this switch will not only produce a list of the current aliases and function-key assignments but will also show the size of the command stack, the minimum stacked command length, the amount of free space in the alias buffer, and the current state (enabled or disabled) of the translator.

Finally, you can uninstall the utility by entering ALIAS /U, subject to the usual limitation that no other memory-resident program has been loaded after ALIAS.

A SAMPLE ALIAS COMMAND FILE

```
/*
/* ALIAS Command file
/*

// ***** CONFIGURATION SWITCHES *****

/s 32          // set stack size to 32
/m 4           // set minimum command size to 4
/b 1024        // set alias buffer size to 1024

// ***** ALIASES *****

a          masm $workfile$;
e          edit $workfile$.asm
g          cd \projects\$workfile$
b          browse $workfile$.lst
wh         chkdsk /v | find "$1"
ty         type
br         browse

// ***** FUNCTION KEY ASSIGNMENTS *****

[f1]*   dir
[sf1]   path = $path$
[f2]    type $1 | more
[f3]    del
[f4]    ren
[f5]    copy
[f6]    xcopy
[f7]    chkdsk
[f8]*   dr                  // DR.COM
[f9]    browse              // BROWSE.COM
[f10]*  cls
```

Figure 2: ALIAS command files are specified when the program is first loaded by using the /F *filename* switch. This sample file sets the command stack to accommodate 32 commands and sets the minimum length for stacking commands at four. (Very short commands such as CD, DIR, and CLS are thus not stacked.) The size of the alias buffer is here set to 1,024 bytes. In addition, a handful of pseudocommands are defined, and each of the function keys is assigned a command string.

HOW ALIAS WORKS

The internal components of ALIAS can be divided into those that support the command-line editor and command-stack functions, those that support alias translation, and those used during the installation process. Since ALIAS.ASM is well commented, only the highlights of each section will be discussed.

ALIAS's file-input feature is simply an extension of the command-line interface used to parse the command line. When ALIAS is executed, it first reduces its memory allocation by a single 64K segment, then requests an additional 32K buffer to hold the contents of the command file. The command line is copied into the file buffer and treated as a one-line file. If the command line contains an /F switch to load in a command file, ALIAS reads the file into the file buffer, allowing it to overwrite the text of the command line. It then resets a pointer to address the start of the file and processes each line of the file.

Each alias and command-line switch is parsed by scanning a line until a character is found. If a forward slash is found, the character immediately following it is compared with the list of supported switches. If the character is verified as a valid one, the position of the matching character in the list is used as an index into a jump table and the corresponding routine is called. This allows command switches to be added to the source code simply by inserting a character into the list and adding the offset of the routine to the jump table. If the character is not preceded by a forward slash, it is assumed to be the first letter in an alias, and control is passed to the SETALIAS routine.

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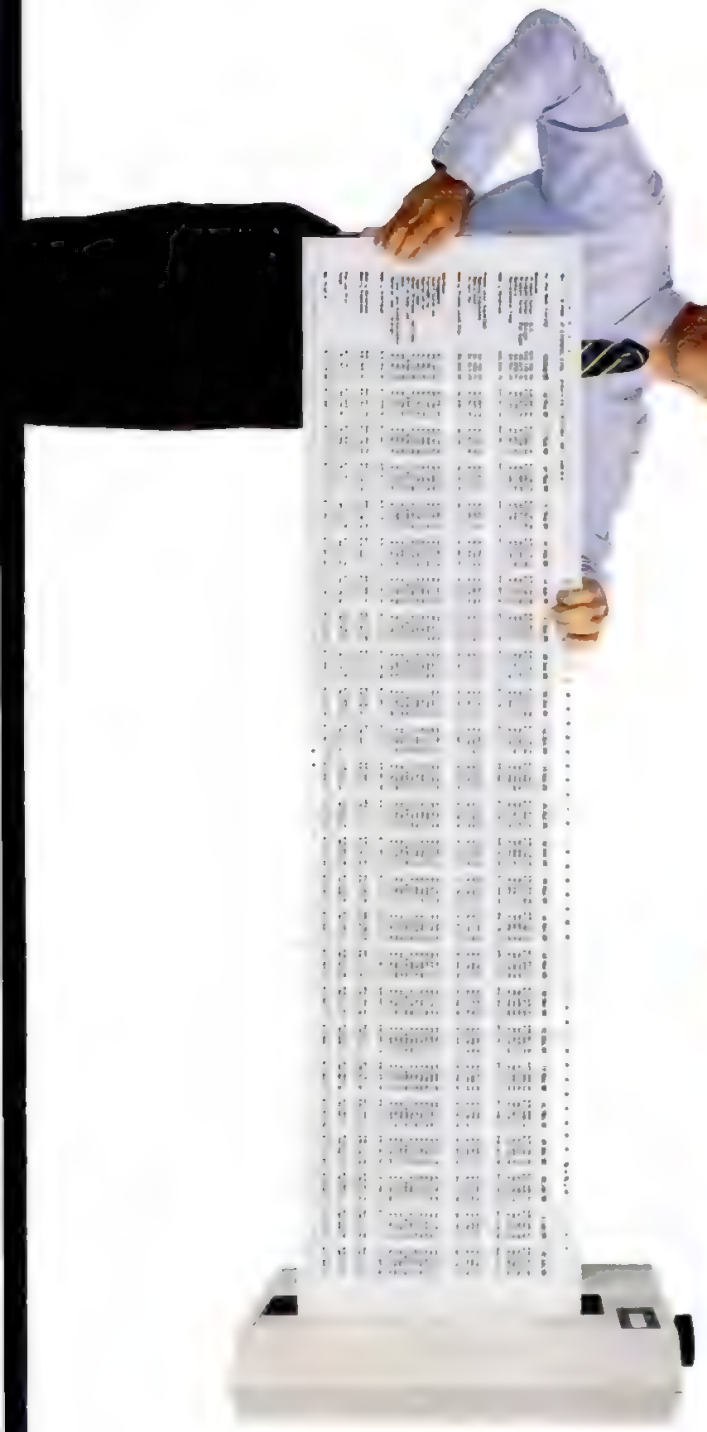

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As alias definitions are parsed, the SETALIAS routine creates a linked list of entries consisting of the alias, the associated command, the length of the two fields, and a pointer to the next entry in the list. Function-key definitions are stored in the same linked list. As the aliases are added to the list, any environment variables present are capitalized so that they will match the variables stored in the master environment block (these are always capitalized). If one or more aliases are already defined, a new alias is simply appended to the end of the current list, buffer space permitting.

Once all commands are processed, ALIAS releases the file buffer memory back to DOS, creates space for its internal program stack, initializes the command-stack buffer, and copies the alias list over the remaining installation code. Finally, the length of the alias buffer is added to the amount of memory needed by the program, interrupt 21h is hooked into, and the program calls the DOS TSR function: interrupt 21h, function 31h.

THE ROLE OF THE PSP

Once installed, ALIAS works by replacing DOS's buffered keyboard input function (interrupt 21h, function 0Ah), which COMMAND.COM uses to solicit input on the command line, with a buffered input routine of its own. Each time function 0Ah is called, ALIAS checks to see if the calling program is COMMAND.COM. If it is, ALIAS substitutes its own more robust command input routine for function 0Ah. If it's not, ALIAS simply passes the request on to DOS. The trick is to know when it's COMMAND.COM that is calling the input function and when it's not.

The secret of the trick lies in the Program Segment Prefix, or PSP. Before a program is run, DOS initializes a special 256-byte region of memory used (among other things) to keep track of open file handles, critical interrupt vectors, and the location of the program's environment block. Since there may be more than one program (and accompanying PSP) in memory—especially if there are other TSRs loaded—DOS activates the current program's PSP before handing control to it. Thus, only one PSP is ever active at a time. When ALIAS intercepts a call to function 0Ah, it calls the undocumented DOS function 51h to determine the address of the active PSP. If that PSP belongs to COMMAND.COM, then ALIAS knows that COMMAND.COM made the call.

This sounds simple, so naturally there's a catch: how does ALIAS come to know what the address of COMMAND.COM's PSP is? Unfortunately, there's no way to get that information using function calls, documented or undocumented. But there are back doors. When ALIAS is installed, it traces the chain of memory control blocks (MCBs) to determine where programs are loaded in memory. Each MCB contains the address of the program that owns the adjacent block of memory as well as the length of the block (in paragraphs). In versions of DOS prior to 4.0, a program could identify COMMAND.COM as being in the first block of memory that owned itself.

DOS 4.0 changed all that. Version 4.0 allows a few special programs such as FASTOPEN and SHARE to be loaded before COMMAND.COM, obsoleting the old method of locating it in memory. But a new addition to the MCB permits even programs running under DOS 4.0 to locate and identify COMMAND.COM. Figure 3 shows two memory-control-block formats: the one used before DOS 4.0 and the one used in DOS 4.0. The addendum to the control block (the last 8 bytes of the block) contains the name of the program that owns the ensuing portion of memory. All ALIAS has to do is check for the string "COMMAND" starting at offset 8 of the memory control block.

Determining which PSP is active without corrupting the system is a challenge in versions of DOS prior to 3.1. While the documented method of determining the active PSP address is to use interrupt 21h, function 62h (which first appeared in DOS 3.0), the much more common method is to use the undocumented function 51h, which was available as early as Version 2.0. A well-known bug in early versions causes DOS to crash when function 51h is called, unless it can first be forced to switch to a different internal stack. Thus ALIAS provides the usual workaround, forcing this switch by setting DOS's critical error flag. The flag is restored as soon as the call to function 51h has been completed.

One implication of ALIAS identifying the caller by its PSP address is that its command-line features won't be available when you shell out of a program and run a secondary copy of the command processor. In this sense, ALIAS works *too* well: it sees that the caller isn't COMMAND.COM (at least not the *original* COMMAND.COM) and passes the call straight through to DOS. The alternative is to have ALIAS track down the filename of the program that called the buffered input function each and every time the call is made. That's a lot of overhead to impose on the program for a small measure of functionality. With ALIAS, we opted to go the former route. The good news is that no matter

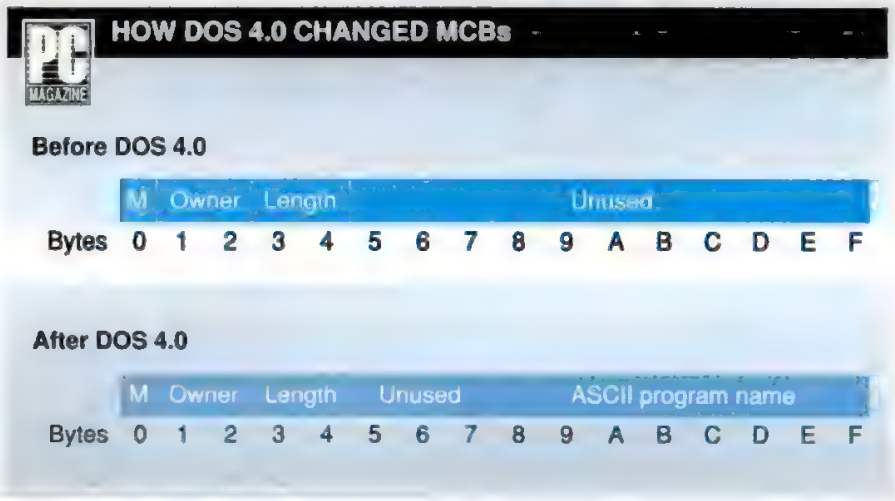

Figure 3: Prior to Version 4.0, DOS used only the first 5 bytes of the 16-byte memory control blocks (MCBs). The MCBs form a linked list that provides a road map to the structure of usable RAM. Beginning with 4.0, DOS allows a few special programs to be loaded before COMMAND.COM, so now the last 8 bytes of the MCB contain the name of the program that owns the ensuing block of memory. When run with DOS 4.0, ALIAS identifies COMMAND.COM by searching the chain of MCBs for the text string "COMMAND". When used with earlier versions of DOS, ALIAS relies on the tried and true assumption that COMMAND.COM resides in the first block of memory that owns itself.

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CONTINUES

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ALIAS Command

Douglas Boling and Jeff Prosise December 26, 1989 (Utilities)

Purpose: A TSR utility that enables DOS command-line editing and recall of previously issued commands and that permits assignment of long commands and environment strings to short synonyms ("aliases") or function keys.

Format:

```
ALIAS [?][/U][/D][/E][/L]
[/F [d:][path]filename]
[/B nn][/M nn][/S nn][alias [command]]
```

Remarks: When loaded without any of its optional switches, ALIAS reserves a buffer size of 512 bytes for user-entered alias strings and a command stack that permits recalling the last 16 commands issued. These defaults (/B 512 and /S 16) can be changed only at load time. At this time, too, the /F switch can be used with a *filename* (plus drive and path) containing regularly used aliases (see Note).

Previously issued commands can be recalled to the command line with the Up and Down Arrow keys. When many commands are stacked, typing a few initial letters before hitting the recall key will speed retrieval by skipping commands that do not match the typed pattern. Use the optional /M *nn* switch, where *nn* is a number, to set a minimum length of command strings to be stacked. The default, /M 1, remembers all commands.

Whether recalled or newly typed, command-line entries can be edited when ALIAS is loaded. The Left and Right Arrow keys move the cursor by character; Ctrl-Left and Ctrl-Right move by word; and Home and End go to the line ends. The Del and Backspace keys delete characters; Ctrl-Backspace deletes the word at the cursor; and Ctrl-End deletes to the end of the line. Pressing Esc clears the command line and returns to the bottom of the command stack. The Ins key toggles between overstrike (the default) and insert mode for character entry on the command line.

The command `ALIAS alias [command]` is used to define an alias or command synonym. The *alias* variable may be any one-word alphanumeric string; the *command* variable may contain multiple words and must end with a carriage return. Defining an alias but omitting the *command* variable removes a previous *alias* assignment. Function keys and their Alt-, Shift-, and Ctrl- combinations may be used in place of *alias* by being designated thus: `[Fn]`, `[AFn]`, `[SFn]`, `[CFn]`, with 1 to 10 as the values of *n*. An asterisk after the close bracket (for example, `[F1]*`) causes immediate command-string

CONTINUES

execution when the function key is pressed; otherwise, Enter must also be pressed. The *command* variable may include replaceable command-line parameters (for example, %1), as in batch files. Environment strings, such as a PATH string, may be used as the *command* variable by being placed between a pair of % signs, provided they do not begin with a numeral.

A list of active aliases can be obtained at any time by entering ALIAS with its /L switch. Alias processing can be temporarily disabled with the /D switch and reenabled with the /E switch. `ALIAS ?` brings up a help screen. The /U switch uninstalls ALIAS from memory, when possible.

Note: A plain ASCII file containing regular user-defined aliases may be installed with the /F switch when ALIAS is loaded, as, for example, `ALIAS /F C:\BIN\MYALIAS.TXT`. This file may be up to 32K and may also contain ALIAS optional switches, as in the sample below. Note that // and /* may be used to add comments on the remainder of a line and that blank lines are not processed.

ENDS

ALIAS BY MODEM

UTILITIES UPGRADES

Like all good software, the programs presented in *PC Magazine* are upgraded and improved. The only way to obtain the modified versions is to download them from PC MagNet. Here is a partial list of the programs that have been upgraded to fix minor bugs and system incompatibilities:

ANSI.COM, Version 1.3
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LITES.COM, Version 1.1
LOG.COM, Version 1.1
MENU.COM, Version 1.1
RN.COM, Version 2.0 (now works under DOS 4.*x*).
SLICE.COM, Version 1.3
SNIPPER.COM, Version 1.2
ZCOPY.COM, Version 1.2

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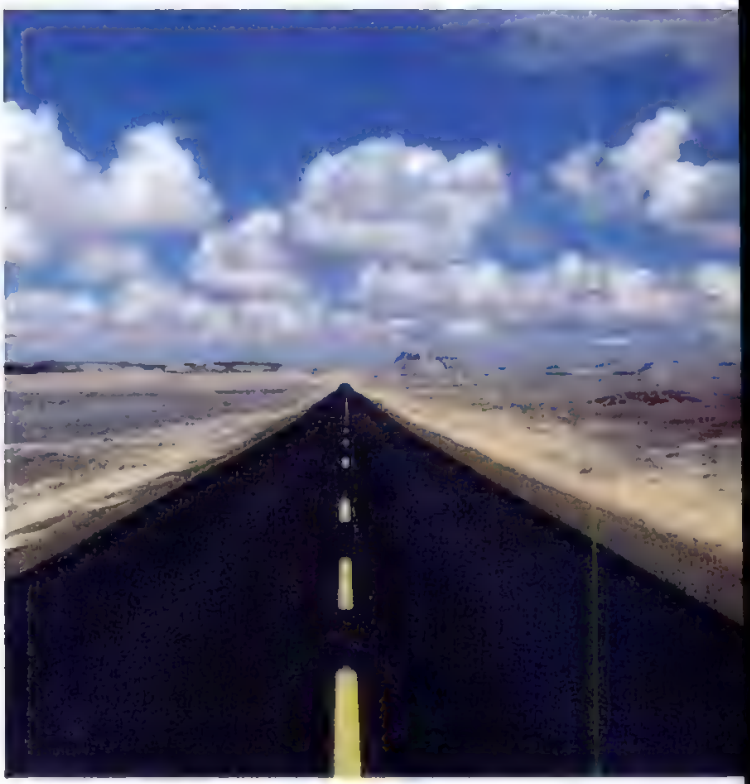

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how many times you shell in and out of a program, ALIAS will be present and working when you finally exit the program and go back to the primary command line.

COMMAND EDITING AND STACKING

ALIAS supplies its own buffered input function, which mimics DOS's function 0Ah but adds command-line editing and command stacking features. The command stack is nothing more than a buffer in which 128 bytes are set aside for each command to be stacked. Its size is determined by the /S parameter entered on the command line; it defaults to 16 commands in the absence of such a switch. The format of an entry in the stack is similar to that used in the function 0Ah input buffer: the first byte specifies the length of the ensuing string, while the bytes that follow contain the string itself.

When the buffer is filled, ALIAS wraps around, overwriting the topmost command with the next one and updating a pointer that defines the current position in the command stack. This creates a circular queue that never runs out of space, similar to that used by the BIOS keyboard buffer.

Like the logic that parses the command line and calls the appropriate routines from a jump table, ALIAS's input function examines keystrokes as they come in, compares the ASCII and scan codes to a list of supported keystrokes, and vectors execution to the corresponding support routines. To see exactly how the various command-line editing features are enacted, you should examine the source code listings for the BACKSPACE and PRINTCHAR routines, which are called from the procedure labeled CMD_INPUT.

ALIAS TRANSLATION

When Enter is pressed, ALIAS terminates the command line with a carriage return and passes control to an internal alias-translation routine. If translation is enabled, ALIAS calls the SEARCH_ALIAS routine to see if there is a match between the first word on the command line and an alias in the alias list.

If an alias is found, it must be translated. As the alias is copied from the list to an internal buffer, it is scanned for any percent signs, which denote "soft" parameters (for example, replaceable parameters and environment variables). If a percent sign is found, the next character is checked to determine if it is part of a replaceable parameter symbol or an environment variable. If the character is a number, the parameter is assumed to be a command-line parameter, and control is passed to the SUBLINEPARAM routine; otherwise, SUBENVVAR is called to search the environment block for a matching variable name.

The SUBLINEPARAM routine scans the original command line entered to find the word indicated by the number. As with batch files, %1 returns the first parameter after the alias, %2 returns the second, and so on. The symbol %0 returns the original alias string without substitution.

SUBENVVAR searches the master environment block to find a match for the environment variable. The environment block is a series of ASCIIZ strings in the form `VARIABLE_NAME = VARIABLE`. If a matching variable name cannot be found, SUBENVVAR returns nothing, and the translation process is continued as if the environment variable had not been included in the alias.

ALIAS makes working with DOS a bit easier, and its usefulness is limited only by the extent of your own imagination.

ALIAS is designed to make working with DOS just a little bit easier. After a while, the editing commands become second nature, and the command stack becomes impossible to live without. The aliasing feature may be the most important of all, especially if you're tired of waiting for one-line batch files to run from the disk. And best of all, its usefulness is limited only by the extent of your own imagination. ■

Douglas Boling is an electrical engineer who has been involved in the design of computer hardware and software for 13 years. Jeff Prosise is a contributing editor of PC Magazine.

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CIRCLE 122 ON READER SERVICE CARD

by
Ray Duncan

Power Programming

Arithmetic Routines for Your Computer Programs, Part 4

In the first three columns in this series on computer arithmetic we looked at the classical algorithms for the four basic integer operations. We also devised a set of assembly language subroutines for multiple-precision integer addition, subtraction, multiplication, and division. It's time now to venture forth from the relatively safe shallows of integer arithmetic into the treacherous depths of real numbers and floating-point arithmetic.

A grade school student is introduced to the real numbers in stages. First, he gets the "counting numbers" (positive integers). Next, the negative numbers are added, completing the set of all integers. Finally, he comes to fractions and their decimal equivalents. To make these concepts easier to visualize, the teacher often uses a "number line": a horizontal line with arrows at both ends (pointing to negative infinity on the left and positive infinity on the right) and with a hashmark (signifying zero) in the middle. Once the integers (. . . –3, –2, –1, 0, 1, 2, 3 . . .) are charted on the number line, it's a fairly easy jump to the notion that there are "numbers between the numbers." The fraction ½ is symbolized by putting a dot on the number line halfway between the 0 and the 1, for example. From there it's but another step to the realization that there are an infinite number of numbers between any two arbitrary points on the number line, the whole comprising the set of real numbers.

At some point in high school—if he chooses algebra, chemistry, and physics over machine shop and varsity athletics—our model student is taught "scientific" or "exponential" notation. This is a tool that allows him to write down real numbers of any desired size or precision. For example, the fraction ¼ can be expressed in scientific notation as $2.5*10^{-1}$.

The "2.5" portion of the notation is called the *mantissa* or *fraction* or *significand*. It has one nonzero digit to the left of the decimal point, and the number of digits after the decimal point indicates the degree of precision to which the number's value is known. (A mantissa in this form is said to be "normalized.") The "10^{-1}" portion is called the *exponent* or *characteristic*; it specifies the location of the decimal point in the number. Teachers have a whole cookbook full of rules for operations on numbers written in scientific notation, such as: "To find the product of two numbers, multiply the mantissas and sum the powers of the exponents."

■ Floating-point numbers present problems not encountered when dealing only with integers, including the question of how to store them in memory.

With such mastery of the real numbers and the means to manipulate them in hand, our student, now a regular whiz kid, may be tempted to adopt a somewhat smug attitude toward matters mathematical. Never mind; his prematurely optimistic outlook will be demolished when he's confronted with imaginary numbers, irrational numbers, complex numbers, infinitesimals, and all the other counterintuitive mathematical things that go bump in the night.

FLOATING POINT ON COMPUTERS

While the methods we use to manipulate floating-point numbers on computers are certainly based on the fundamental rules and algorithms we were all taught way back when, there are several important differences we must bear in mind.

For one thing, most computers and high-level language libraries support only a limited number of floating-point formats (typically only two), and these formats, by nature, have a finite precision and range. This means that you cannot possibly represent every real number as a floating-point number on your computer. In fact, the number of numbers that you can't express is infinitely larger than the number of numbers that you can represent. When your CPU or compiler was designed, its creators picked a floating-point data format (or formats) they felt would be sufficient for most "normal" applications and yet could be implemented reasonably efficiently. If the requirements of your particular application program fall outside the bounds foreseen by those designers, you either have to roll your own floating-point routines or do without.

Not only are your computer's floating-point numbers a minuscule subset of the set of real numbers, they do not map onto the real numbers in a uniform way. For example, if you plot the numbers that can be represented by a 32-bit *integer* onto the real number line, you'll see a set of points that march monotonically along the line from –2,147,483,648 (2^{-31}) to 2,147,483,647 (2^{31}–1). But if you now plot the numbers that can be represented by a 32-bit *floating-point* number onto the real number line, you'll be in for a surprise. The number of numbers that can be represented in the floating-point format is exactly the same as for the integer format

(think about it!). But, as illustrated in Figure 1, the floating-point numbers are densely clustered around zero, and become increasingly sparse as the distance from zero increases. Of course, the smallest and largest floating-point numbers are far smaller (or larger) than the smallest and largest integer, but this dynamic range is gained at the expense of precision: there are only so many bits to go around.

Still a third set of new considerations arises from the fact that while people prefer to compute in base 10, computers find base 2 (binary) much more to their liking. As application designers and programmers, we like to keep everybody happy ("from each according to his abilities, to each according to his needs" as the famous coder Karl Marx enjoined in his 1875 tutorial, "Criticism of the Gotha Programme"). To do so, each time a number is input or output it must be converted from decimal to binary or vice versa. This caused no real problems when we were working with integers. It becomes a thorny issue with floating point, however, because some apparently quite ordinary decimal numbers cannot be expressed exactly in binary floating point (one such number is $1.0*10^{-1}$).

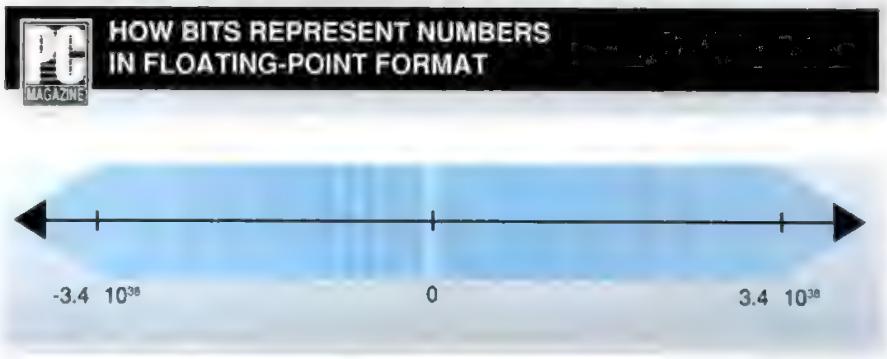

Figure 1: While the number of numbers that can be represented by a given number of bits is the same for integer and floating-point formats, in floating point the *range* of numbers is greater, but they occur at increasing intervals as they get further away from zero.

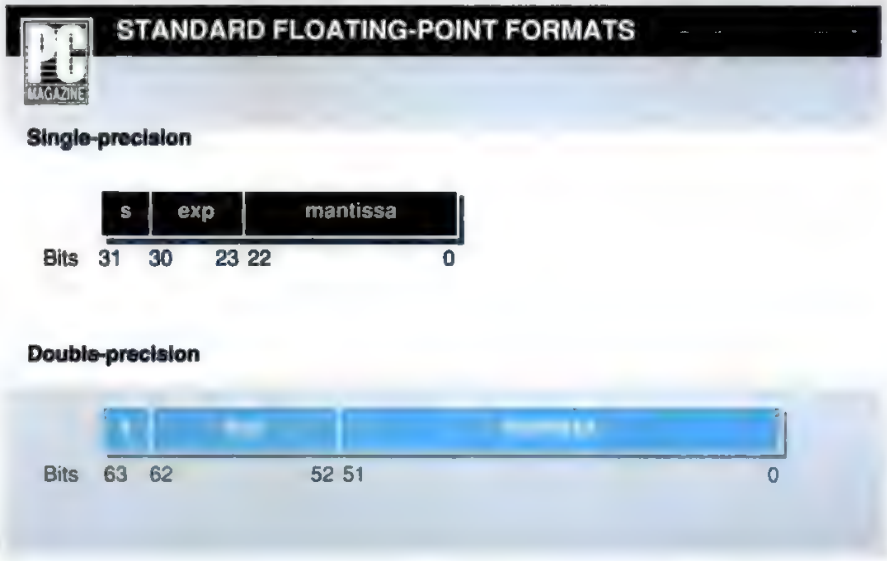

Figure 2: The single-precision and double-precision floating-point formats specified by the ANSI/IEEE 754 Standard for Binary Floating-Point Arithmetic. The Standard also specifies "extended" single and double formats, which are not discussed here.

BINARY FLOATING-POINT DATA FORMATS

Once a decimal floating-point number has been converted to a normalized binary floating number, it can be thought of as having the form

```
1.bbbbb...  * 2^n
```

Where each bit *b* in the mantissa is a zero or a one. The mantissa is normalized by adjusting the exponent so that the most significant one bit is to the left of the binary point; in other words, the mantissa is always greater than or equal to 1 and less than 2.

How are these floating-point numbers actually stored in memory? The history of this topic is one that begins in utter chaos but (for once) has a happy ending. In the early days of computing, a thousand flowers bloomed and a thousand schools of thought contended, with the inevitable result that nearly every compiler and CPU used a different floating-point data format. This made it very difficult to transport data from one machine to another, or even from a program written in one high-level language to one written in another.

Fortunately, in the late 1970s, a concerted effort to standardize binary floating-point arithmetic was begun, first under the auspices of the ACM, and later under the IEEE Computer Society. This undertaking drew upon several proposals, the most important of which was the so-called KCS Proposal (written by Kahan, Connen, and Stone in 1978). These proposals, in turn, represented an integration of concepts and techniques that dated back to the earliest days of computer science. The IEEE committee's work resulted in the publication in 1981 of the draft IEEE 754 Standard for Binary Floating-Point Arithmetic. This was adopted (in a slightly modified form) as an official ANSI/IEEE Standard in 1985.

The IEEE 754 Standard was principally directed at making floating-point calculations safe and predictable for programmers untrained in numeric analysis (that's nearly all of us!). It did this by specifying, in great detail, the degree of accuracy to which computations must be carried out, rounding behavior, error and exception handling, and the results of the basic floating-point arithmetic operations, comparisons, and conversions. The Standard also specified binary formats for floating-point numbers, formats that were rapidly adopted by the industry and are now widely supported in hardware and software.

The two most important floating-point data formats described in the IEEE 754 Standard are shown in Figure 2. The single-precision format occupies 32 bits (a double word for Intel processors). The

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double-precision format requires 64 bits (a quad word for Intel CPUs). Both formats consist of three fields: a sign bit, which is always the most significant bit, followed by the binary exponent, with the mantissa in the remaining, least significant bits. Single-precision numbers can take on values in the (approximate) range $\pm 1.18*10^{-38}$ through $\pm 3.40*10^{38}$; double-precision numbers lie in the range $\pm 2.23*10^{-308}$ to $\pm 1.80*10^{308}$.

The sign bit is 1 if the number is negative and 0 if the number is positive. The mantissa is unsigned and does not change with the sign of the floating-point number. Because the mantissa is left-normalized, its most significant bit is (by definition) always 1. Consequently, the IEEE 754 designers pulled off a neat trick: they specified that the mantissa has an "implied leading bit," which is always 1 and is not present in the actual data. This allows an extra bit of precision to be squeezed out of each floating-point format.

The 8087 provided a hardware implementation of the entire IEEE 754 Standard.

The exponent field in both types of floating-point numbers is "biased"; that is, offset from zero by a fixed amount. For single-precision numbers, which have an 8-bit exponent, 127 (7Fh) in the exponent field corresponds to a true exponent value of 0. Double-precision numbers, which have an 11-bit exponent field, use an exponent bias of 1,023 (3FFh). This bias allows the reciprocal of any normalized floating-point number to be represented without underflow. The relative sizes of the exponent fields in the two formats were chosen so that they would allow a double-precision number to accommodate the product of as many as eight single-precision numbers without the possibility of overflow.

The exponent of an IEEE 754 floating-point number can also take on two "magic" values, causing the number to be handled in a special way (Figure 3). If all bits of the exponent are zero, then the floating-point number is either zero or a "denormalized" number—the result of a "graceful underflow" (more about this in a later installment). If all bits of the exponent are set, then the floating-point number represents either infinity or a special signalling value: NaN (Not a Number).

A couple of practical examples of binary floating-point data will help clarify the way the standard works. Consider the 4-byte (32-bit), single-precision floating-point number

```
41h 20h 00h 00h
```

We see that the sign bit is 0, the biased exponent is 10000010B or 82h, and the mantissa (after restoring the "implied leading bit") is

```
1010000000000000000000000B
```

or A00000h. Correcting for the exponent bias, we have $1.010B*2^3$, or 10 decimal.

As another example, consider the double-precision floating-point number

```
BFh F0h 00h 00h 00h 00h 00h 00h
```

which occupies 8 bytes (64 bits). The sign bit is 1, the biased exponent is 01111111110B or 3FEh, and the mantissa (after inserting the "implied leading bit") is 10000000000000h. Correcting for the exponent bias, we have $-1.0B*2^{-1}$, or –0.5 decimal.

NUMERIC COPROCESSORS

The ANSI/IEEE 754 Standard would have been less influential had it not been for Intel's 1980 release of the 8087 numeric coprocessor for the 8086 and 8088 CPUs. The 8087 provided a hardware implementation of the entire (draft) IEEE 754 Standard, even down to its most esoteric aspects (such as supporting two flavors of infinity: affine and projective). This chip itself quickly became the yardstick by which the compliance with the impending Standard of all other CPUs, numeric coprocessors, and software floating-point libraries was judged. The 8087 also brought an unprecedented (and largely unanticipated) amount of number-crunching power within the reach of every microcomputer user. This made it possible to migrate many demanding minicomputer and mainframe applications onto personal computers for the first time.

The 8087 was followed by the 80287 numeric coprocessor in 1983, and by the 80387 numeric coprocessor in 1987. Designed to work with the 80286 CPU, the 80287 was the first of the Intel coprocessors to support memory protection and multitasking. The 80387, designed to work with the 80386 CPU, was enhanced with several powerful new trigonometric instructions. Each successive chip supported a larger memory address space, and each benefited from the technological advances in large-scale integration made during the period. These included both an increase in clock speeds and a decrease in the number of machine cycles required for

SPECIAL IEEE-STANDARD EXPONENT VALUES

Exponent bits	Mantissa bits	Special meaning
all zero	all zero	floating-point zero
all zero	nonzero	denormalized floating-point number (usually result of "graceful underflow")
all set	all zero	infinity
all set	nonzero	"Not a Number" or "NaN" (various reserved mantissa values are used to signal overflow, unrecoverable underflow, invalid operands, invalid result, inexact result, and so on)

Figure 3: The IEEE 754 Standard reserves certain exponent values. Floating-point numbers with all bits zero or all bits set in the exponent field are trapped and receive special treatment.

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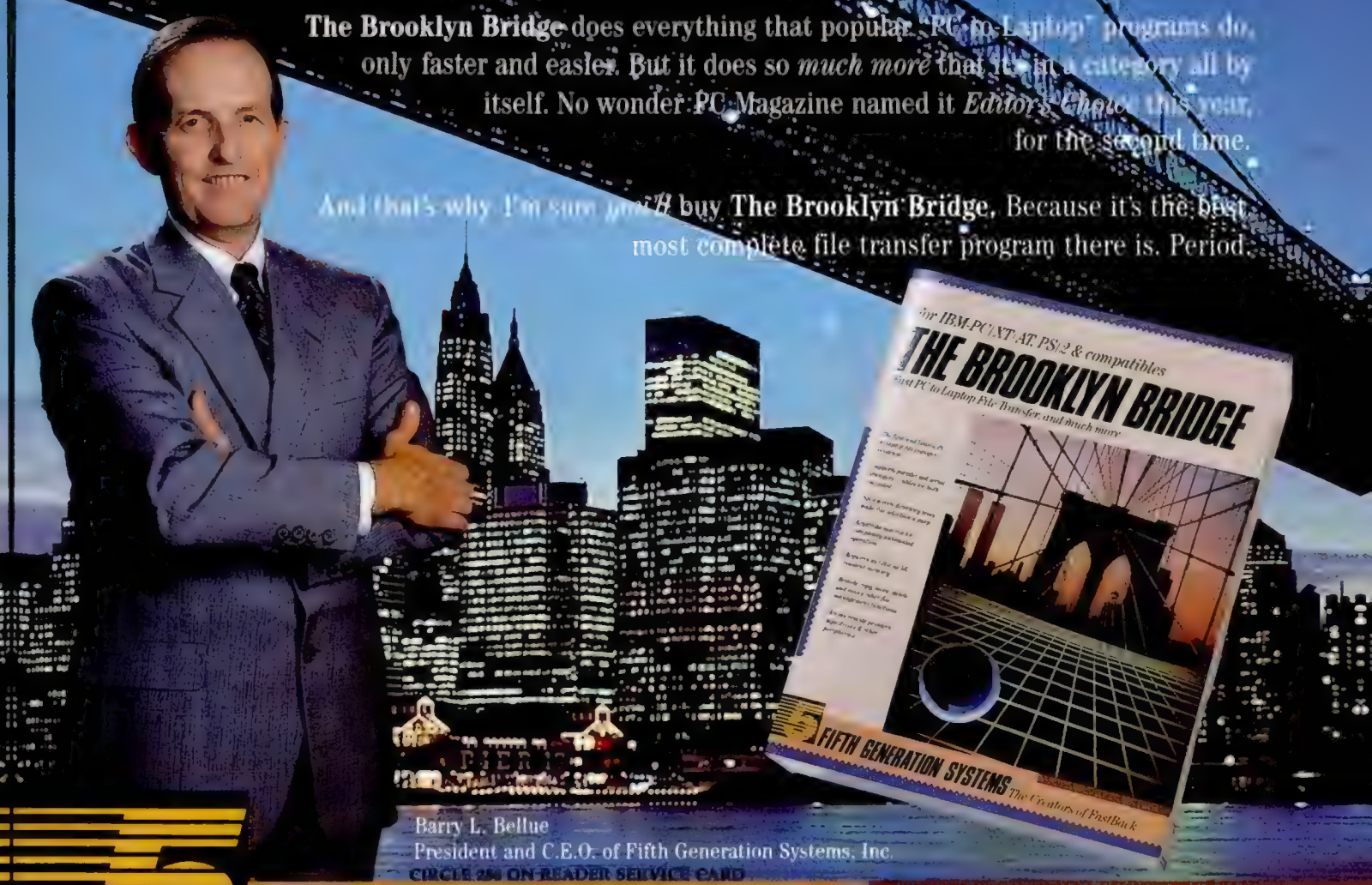

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each floating-point operation. For a typical floating-point instruction mix, the performance of the 20-MHz 80386/387 combination is about 16 times better than that of a 5-MHz 8086/8087 duo.

The 8087, 80287, and 80387 chips are called "coprocessors" because they are closely coupled to the system's CPU, have a highly specialized instruction set, and cannot function alone. By sharing the same data and address bus as the main CPU, the coprocessors monitor the CPU's instruction stream as it is fetched from memory and flows by on the data bus. Floating-point instructions begin with a special "escape code" that is recognized and acted upon by the numeric coprocessor; the CPU essentially ignores the floating-point instructions except to perform address calculations on behalf of the numeric coprocessor when they are needed.

The 80*x*87 coprocessors were not the first floating-point arithmetic chips available for use with microprocessors. A number of early 8080, Z-80, and even 8086/88-based microcomputers had sockets for the AMD 9511 and 9512 chips, which supported 32-bit and 64-bit floating-point operations, respectively. But the AMD products were not coprocessors (they were addressed through an 8-bit I/O port like a peripheral device). Moreover, they used nonstandard data formats, were slow and clumsy to program, and enjoyed little if no support in commercial, mass-market software packages. The 80*x*87 chips were the first hardware number-crunchers that were cheap enough, and pervasive enough (thanks to the 8087 socket built into the very first PC motherboard), to motivate mass-market software publishers to have their programs check for the presence of a numeric coprocessor and use the coprocessor if it was available.

In the next installment, I'll discuss the architecture of the 80*x*87 series in more detail, and present routines that allow you to detect and exploit numeric coprocessors in your own programs.

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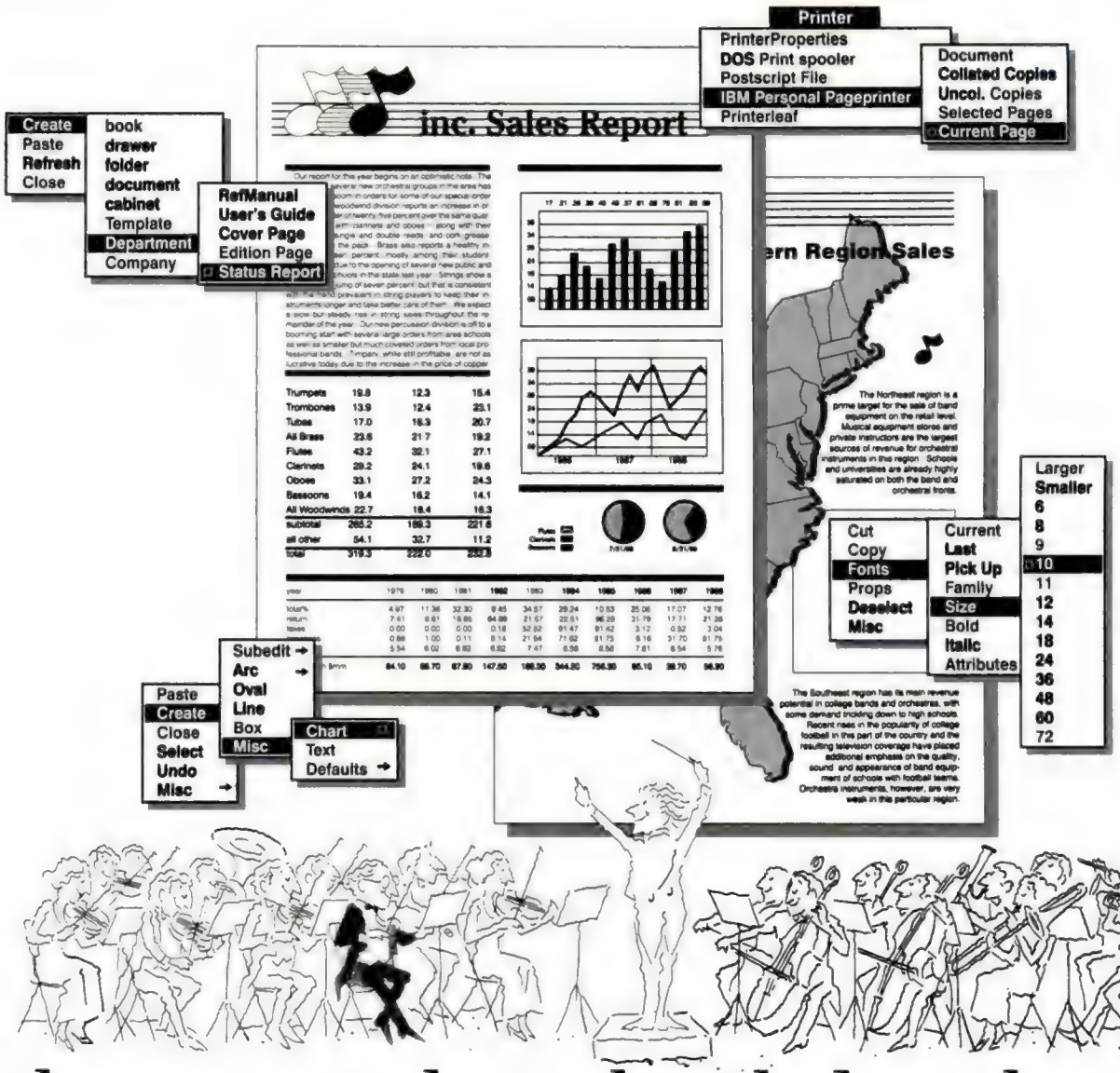

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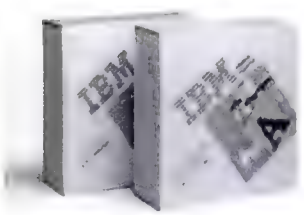

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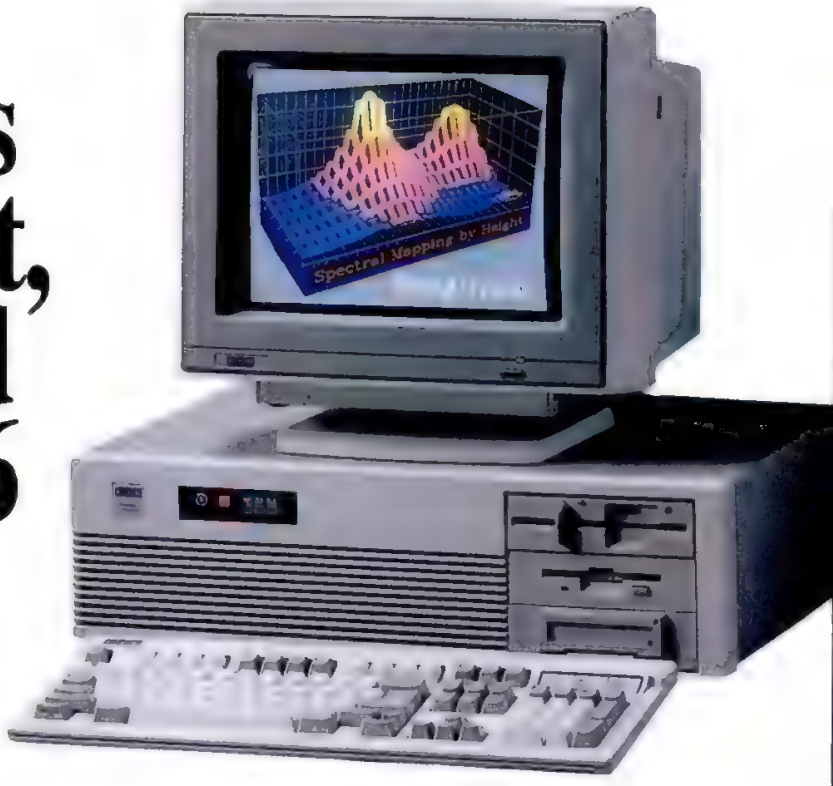

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CIRCLE 157 ON READER SERVICE CARD

by
Douglas Cobb
and Steven Cobb

Spreadsheet Clinic

- **UNDERLINING LABELS:** Here's a handy macro that enables you to underline 1-2-3 labels quickly and easily.
- **LUCID 3-D PRINTING:** An easy technique that lets you embed printer codes in Lucid 3-D spreadsheets.
- **COLORING EXCEL WORKSHEETS:** Assigning colors to different values makes a worksheet easier to read—but be aware that it could significantly alter your results.
- **COUNTING WEEKDAYS:** Calculate the number of weekdays in a given period using either Lotus 1-2-3, Microsoft Excel, or Quattro.

UNDERLINING LABELS

Like other users of *Lotus 1-2-3*, I like to underline many of the labels in my worksheets. To do this, I used to type a series of hyphens into the cell that is below the label I wanted to underline. Now I just use the macro that is shown in Figure 1, which automates this process.

In order to use this *1-2-3* macro, position the cell pointer on the cell that you want to underline and press Alt-U. This copies the entry into the cell immediately below it and moves the cell pointer there. The next statement puts the copy of the label onto the Edit line and deletes all but the label prefix. For example, if the cell pointer had been on cell Z11, which contained the label "1st Quarter, *1-2-3* would have pressed the backspace key 11 times, thereby leaving only the label prefix " on the Edit line.

At this point, *1-2-3* executes the {For} statement in cell B3. Because the cell named CHAR (B6) contains the label '-, *1-2-3* now types one hyphen for each character in the label. Since the macro hasn't locked the modified label back into the current cell, the @CELLPOINTER function returns the length of the label that *1-2-3* copied into that cell originally. These hyphens will appear to the right of the label prefix on the Edit line.

As soon as *1-2-3* has made one pass through the loop for each of the characters in the label, it presses the Enter key. This replaces the label in the current cell (the cell below the one that contains the label you want to underline) with the new label—one that consists of as many hyphens as there are characters in the cell above it. Since this label retains the same prefix as the original label, each of the hyphens will be aligned underneath one of the characters in the original label.

Michael D. Thyfault
LaGrange, Illinois

1-2-3 MACRO — **COMPLETE LISTING**

```
     A        B        C        D        E        F        G        H
1    \u       /c~{Down}~{Down}
2             {Edit}{BS @LENGTH(@CELLPOINTER("contents"))}
3             {For COUNT,1,@LENGTH(@CELLPOINTER("contents")),1,CHAR}
4
5    COUNT
6    CHAR     -
7
```

Figure 1: This macro automatically figures out the right number of underscores to use and then underlines the labels in a worksheet.

PC MAGAZINE This macro makes it easy to underline labels. As an alternative to this macro, however, you can use a formula in the form

```
@IF(@CELL("prefix",cell)="'",
@REPEAT("-",@LENGTH(cell)),
@IF(@CELL("prefix",cell)="^",
@REPEAT("",@INT((@CELL("width",cell)-
@LENGTH(cell))/2))&
@REPEAT("-",@LENGTH(cell)),
@REPEAT(" ",@CELL("width",cell)-
@LENGTH(cell)-1)&
@REPEAT("-",@LENGTH(cell))))
```

to underline labels. To do this, simply enter this formula into the cell below the one that you want to underline, substituting the address of the label-containing cell for the word cell in the formula. When *1-2-3* recalculates this formula, it will return a string that consists of one hyphen for each of the characters in the label, plus enough leading space characters so that each hyphen appears precisely underneath one of the characters in the label. Each time you recalculate the worksheet, *1-2-3* will update the result of this formula, adjusting it for changes in column width, label alignment, and so forth.

LUCID 3-D PRINTING

Here's a technique that makes it easy to embed printer codes in spreadsheets done in *Lucid 3-D*. First, create a label file (using *Lucid*'s NotePad) containing the printer codes you use most. Each line of the file should contain a description of the attribute followed by the code that invokes that attribute. For example,

```
Bold On {27}{69}
Bold Off {27}{70}
Italic On {27}{52}
Italic Off {27}{53}
```

Be sure to give the file an .LBL extension when you save it.

Once you have created this file, you can copy codes from it into a cell of a worksheet.

Spreadsheet Clinic

First press F2, F6, and then F6 again to reveal the names of all the .LBL files in the current directory. Highlight the name of the file that contains the printer codes and press Enter. The file will be displayed. Then move the highlight to the line that contains the code you want to embed and press Enter. The line that contains the printer code will be placed on the Edit line of your spreadsheet. Use the F8 key and the Right and Left Arrow keys to select the code. Press Del to cut it to the clipboard and Esc to clear the entry from the edit line. Finally, move the cell pointer to the cell into which you want to enter the code, press Ins, choose Text, and press Enter. *Lucid* will copy the code from the clipboard into the current cell.

Since *Lucid* replaces some ASCII codes with the characters they represent, the code that it enters into the cell may not look the same as it does in the file. However, it will invoke the appropriate attribute.

Robert Folley
Stowe, Vermont

PC MAGAZINE You can use this same technique to create setup strings for the entire worksheet. To do this, follow the steps outlined above until you have used the Del key to cut the code to the clipboard and pressed Esc to clear the Edit line. Then issue the /Print Options Setup codes command, press the Ins key, and choose Yes.

COLORING EXCEL WORKSHEETS

Using *Excel*'s custom formats, you can display different types of entries in various colors. The custom formats allow up to four sections, which control the display of positive and negative values, 0, and text.

To assign a color, insert the name of the color (red, green, blue, yellow, magenta, cyan, black, or white) in the section of the format that controls the display of that type of entry. Be sure to enclose the name of the color in square brackets and separate each section from the next with semicolons.

For example, the format

```
[Red];[Blue];[Yellow];[Green]
```

commands *Excel* to display positive values in red, negative values in blue, 0 in yellow, and text in green. The format

```
[Cyan]$,$$0;[Magenta]-$,$$0
```

instructs *Excel* to display positive values in cyan with comma separators and to display negative values in magenta with comma separators and a leading minus sign.

Excel allows you to control the display of only the four types of entries mentioned above, but you can assign colors based on almost any criteria. You can even *transform* entries so that they fit into one of the four color-controllable categories, then create a custom format that assigns this category the color you want.

Suppose that cell G12 contains the formula =C12+E12 and that cells C12 and E12 always contain positive values. You'd like any result less than or equal to 500 to be displayed in blue, and results greater than 500 but less than or equal to 750 to be displayed in red; and if they're greater than 750, displayed in green. You also want all results shown with comma separators and rounded to the nearest integer.

To do this, replace the formula in cell G12 with the formula

```
=IF(C12+E12<=500,C12+E12,
IF(C12+E12<=750,-1*(C12+E12),
FIXED(C12+E12,0)))
```

and assign the format

```
[Blue]$,$$0;[Red]$,$$0;;[Green]
```

to this cell. Now, if the sum of the values in cells C12 and E12 is less than or equal to 500, the function returns that sum and, since it is a positive value, *Excel* displays it in blue, with comma separators and rounded to the nearest integer.

If the sum of the values is greater than 500 but less than or equal to 750, *Excel* multiplies it by –1. Since the function will now return a negative value, the second portion of the format controls its display. [Red]#,##0 instructs *Excel* to display the results in red and round the value to the nearest integer, with comma separators, but without a leading minus sign. Consequently, if the sum of the values in cells C12 and E12 is 567.89, *Excel* will display it as 568, in red characters.

If the sum of the values is greater than 750, the function FIXED(C12+E12,0) will return the text form of the sum, rounded to the nearest integer, with comma separators. Since the result is a text value, the fourth part of the format determines that it's displayed in green (as shown in Figure 2).

Cam Larson
Culver City, California

PC MAGAZINE This technique is useful in a variety of situations. However, the second part of the previous example also shows that it is potentially hazardous since the format falsely represents the function. If the sum of the values in cells C12 and E12 is greater than 500 but less than 750, the function will return the negative form of that sum. However, the format obscures the minus sign. Therefore, it looks as if the function returns a positive value rather than a negative one. Similarly, if the sum is greater than 750, *Excel* will return a text value rather than a numeric value.

In addition, formulas that reference these functions won't return the results you would expect. For example, if the sum of the values in cells C12 and E12 is 567.89, the formula =G12+1 would return the value –566.89, not 569. Although *Excel* dis-

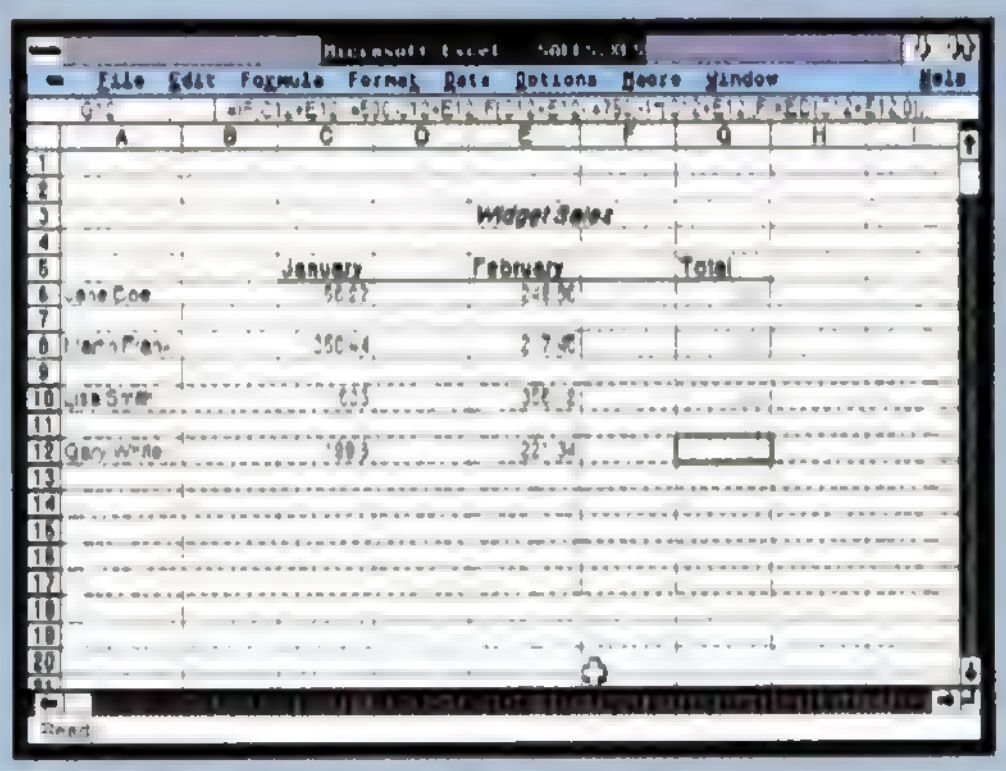
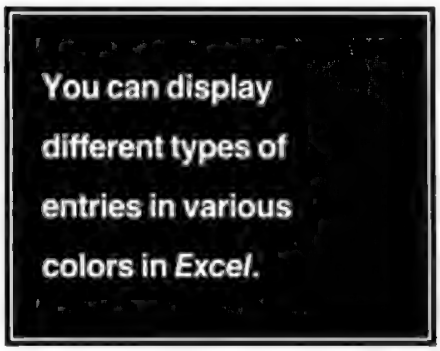


Figure 2: *Excel* lets you assign up to four colors to different types of values. This makes it easier to quickly interpret formula results displayed on the screen.

plays the value 568 in cell G12, the formula uses the value –567.89, which is the actual result of the function in this cell. Similarly, if the sum of the values in cells



C12 and E12 is 890.12, the formula =SUM(G12,1) would return the value 1, not the value 891. Although *Excel* displays the value 890 in cell G12, the formula uses the actual result of the function—the text value 890—which, in the context of a SUM() function, has the value 0.

COUNTING WEEKDAYS

I sometimes need to calculate the number of weekdays in a given period. To do this, I use a formula in the form

```
@INT((end-start+1)/7)*5
+@MOD(end-start+1,7)
-@IF(@MOD(start,7)=1,
@IF(@MOD(end-start+1,7)>=1,1,0),
@IF(@MOD(start,7)=0,
@IF(@MOD(end-start+1,7)=1,1,
@IF(@MOD(end-start+1,7)>1,2,0)),
@IF(@MOD(start,7)+@MOD(end-start+1,
7)=8,1,@IF(@MOD(start,7)
+@MOD(end-start+1,7)>8,2,0))))
```

where `start` is a reference to a cell that contains the serial date value of the first day in the period, and `end` is a reference to a cell that contains the serial date value of the final day in the period.

There are three functional parts to this weekday-counting formula. The first, `@INT((end-start+1)/7)*5`, counts the number of weekdays in complete 7-day increments within a period, beginning with the starting date and including the ending date. The second part, `+@MOD(end-start+1,7)`, counts the remaining days (both weekdays and weekend days) in a period. The remaining formula calculates the number of weekend days included in the result returned by the second portion of the formula, then subtracts that number from the sum of the previous two parts.

For example, suppose you want to calculate the number of weekdays between and including July 1, 1989 and July 31, 1989. You would simply enter the function `@DATE(89,7,1)` into cell B1, the function `@DATE(89,7,31)` into cell B2, and

```
@INT((B2-B1+1)/7)*5
+@MOD(B2-B1+1,7)
-@IF(@MOD(B1,7)=1,
@IF(@MOD(B2-B1+1,7)>=1,1,0),
@IF(@MOD(B1,7)=0,
@IF(@MOD(B2-B1+1,7)=1,1,
@IF(@MOD(B2-B1+1,7)>1,2,0)),
@IF(@MOD(B1,7)+@MOD(B2-B1+1,
7)=8,1,@IF(@MOD(B1,7)
+@MOD(B2-B1+1,7)>8,2,0))))
```

into another cell of the worksheet. Since the period described by these two dates spans 4 weeks, the first part of this function returns the value 20. The second returns the value 3—the number of days in excess of the complete weeks. Since 2 of the 3 extra days are weekend days (Saturday, July 29, and Sunday, July 30), the third part of this formula returns the value 2. Consequently, the formula as a whole returns the value 20+3-2=21—the correct number of weekdays between and including these 2 days.

Grand Britt
Portland, Oregon

PC MAGAZINE This weekday-counting formula works quite well in the *Quattro* program as well as *Lotus 1-2-3*. And you can also use the function

```
=INT((end-start+1)/7)*5
+MOD(end-start+1,7)
-IF(WEEKDAY(start)=1,IF(MOD(end-
start+1,7)>=1,1,0),IF(WEEKDAY(start)
+MOD(end-start+1,7)=8,1,IF(WEEKDAY
(start)+MOD(end-start+1,7)>8,2,0)))
```

instead, if you use *Excel*.

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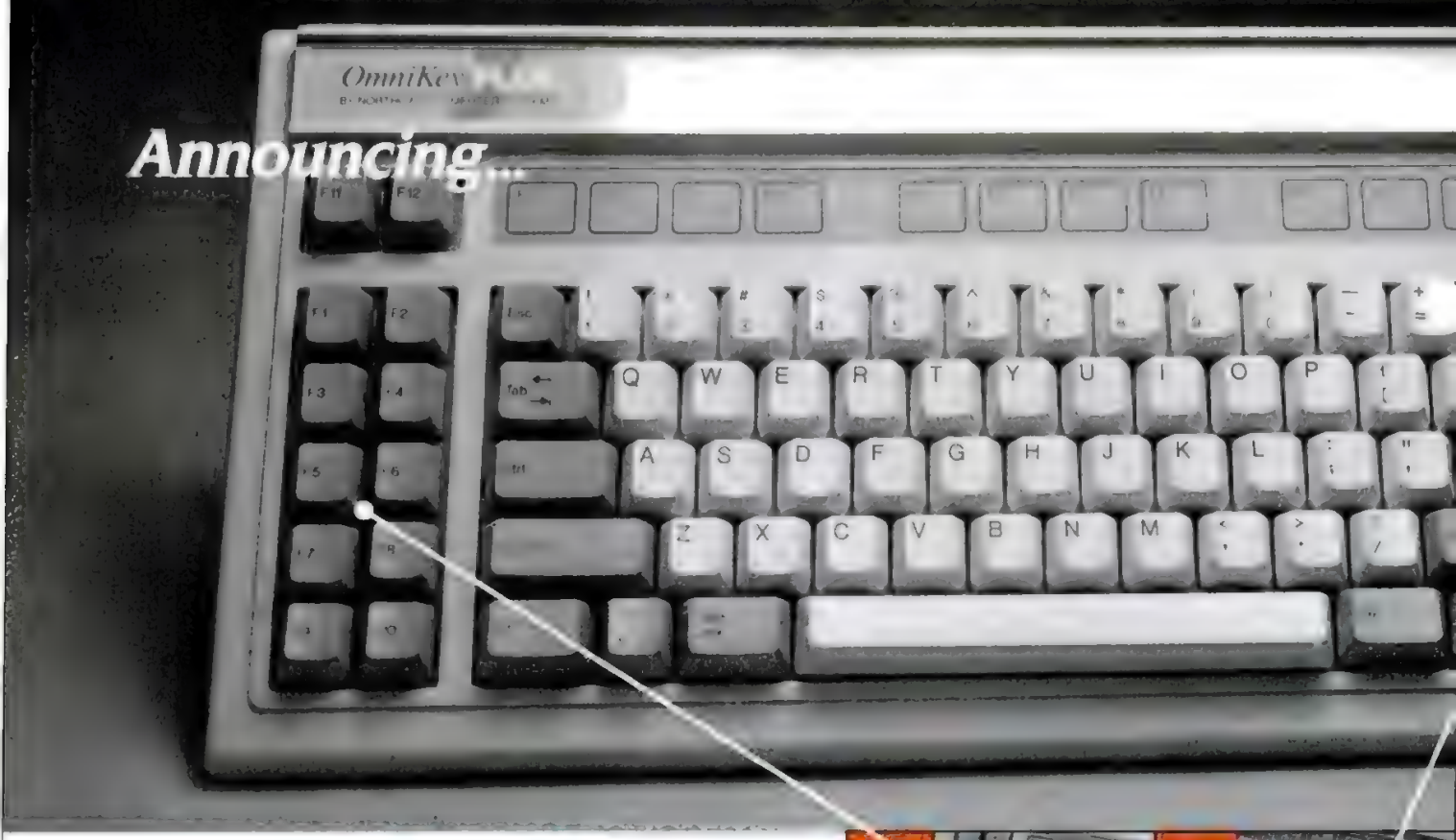

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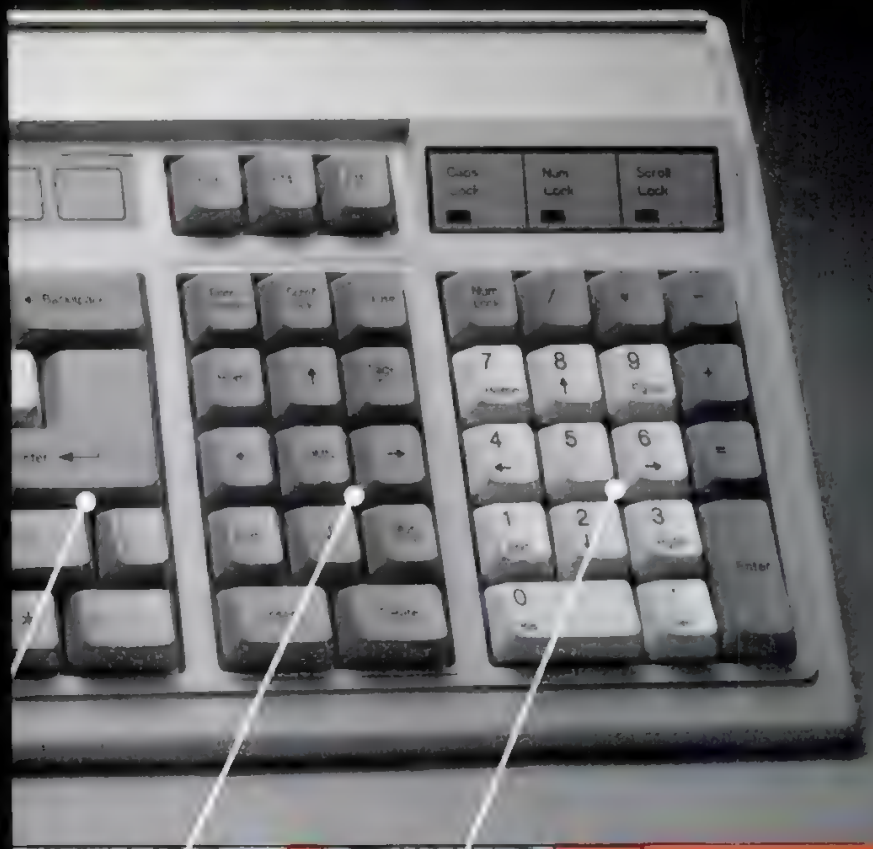

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CIRCLE 358 ON READER SERVICE CARD

by
Neil J. Rubenking

User-to-User

MAXIMIZING MEMORY

Recently, a friend of mine was working with a very large file when he began to get warnings that he was running out of memory. He needed to make his file larger still, so he asked me what he could do to get more memory. After determining what he *actually* needed, I advised him to delete some of his TSRs temporarily to gain a few more kilobytes.

The blank look that followed prompted me to look at his system. Pointing to a large block of commands in his AUTOEXEC .BAT, I asked, "What are these?" Sheepishly he replied, "Oh, those are just a few little fixes that I've collected." The "few" were actually 17. I had never seen that many TSRs live with each other before. "But they're only a couple of bytes each!" he said. A directory check confirmed that the files contained only between 20 and 350 bytes each.

"I've totalled them up and they use only a kilobyte or two," he said. Running the DOS MEM command and totaling the result produced a startling revelation and confirmed my guess: they really occupied almost 20K of memory.

It took a little while for me to explain to him that for each "little fix" of his, DOS actually allocated a good bit more memory than he had thought. Each program had its own 256-byte Program Segment Prefix (PSP), a part of any active program. Each also had its own copy of the environment that ran 60 or more bytes in length. This was because of the simplicity of the programs he was using, since most just latched onto one or more interrupt vectors and then terminated without releasing the environment space back to DOS. The little program that "used only 20 bytes" actually used over 300! Not much memory by itself, but it quickly added up. And, inevitably, unusable small holes had also developed in the map of his system's memory.

Ruthless weeding of unnecessary programs freed up almost 17K. Temporarily removing some of the larger commercial programs gave him much more.

- MAXIMIZING MEMORY: Those tiny TSRs take more RAM than you think.
- LOG YOUR COMPUTER USE: Keep track of the time you spend with various applications.
- SCHEDULING AUTOMATIC BACKUPS: Don't want to back up every day? How about every five days instead?
- MERGING PROGRAMS AND DOCUMENTATION: Two ways to add notes to seldom-used utilities.

His CONFIG.SYS file was also a mess. He had used a "more is better" philosophy and had nearly maxed out almost every DOS command. A little paring on the size of his BUFFERS, FCBS, FILES, STACKS, and LASTDRIVE commands freed still more memory.

Mark Treadwell
LaVale, Maryland

PC MAGAZINE Every TSR gets a complete copy of your environment. Some of them return the space allocated for the environment to DOS, but quite a few do not. If you've expanded your master environment with a SHELL= statement in CONFIG.SYS, and if you've filled it with a long PATH, a fancy PROMPT, and scads of variables, you could be losing hundreds of bytes with every TSR you load.

There *is* a simple solution that will save you most of those bytes. Load all your TSRs *before* you set a PATH, PROMPT, or any other variables. That way they'll get a minimal environment, containing only the COMSPEC variable, set by DOS itself to contain the full path of COMMAND .COM. If you really want to be frugal, you can experiment with clearing the COMSPEC variable and restoring it after you load your TSRs.

LOG YOUR COMPUTER USE

Scott Evans's suggestion for automatically logging each time your computer is booted (User-to-User, February 28, 1989) prompted me to send a batch file I use to record the time I spend working with QuickBASIC. The method that I use, however, is somewhat different because it doesn't require changing the system prompt or invoking a secondary command processor. Instead it makes use of DOS's DIR command and FIND filter.

QB.BAT (Figure 1) keeps a record of each time I start or end a session in QuickBASIC in a file called QB.LOG. (It assumes that QB.LOG is in subdirectory C:\RECORDS and the QuickBASIC program file, QB.EXE, is in subdirectory C:\QB45.)

The third line in QB.BAT creates a temporary zero-length file called START.QB. The fourth line appends the directory listing of START.QB to QB.LOG after passing it through the FIND filter to strip off unwanted information such as the "drive volume label," "number of files," and "bytes free" statements generated by DIR. If QB.LOG doesn't exist, line four will create it.

Line five then erases START.QB and the next two lines put you into the application program, QuickBASIC.

When you exit from the application, the process is repeated except that this time the temporary zero-length file is called END.QB. After you run QB.BAT a couple of times, QB.LOG will look something like the following:

```
START   QB   0    2-12-89    3:05p
END     QB   0    2-12-89    4:57p
START   QB   0    2-14-89    8:44a
END     QB   0    2-14-89   12:21p
```

You can create an automatic logging system for almost any application program

by replacing the letters QB in this example with a two- or three-character mnemonic representing the specific application whose use you want to track. You can even have several batch files for different applications, each appended to one common LOG file. The listing will identify the application with your two- or three-character mnemonic and will indicate the start and end times of each period of use.

Dick Juhrden
Wilmington, Delaware

To claim a tax write-off on a computer that's used for both business and personal work, you need a contemporaneous log of its use. LOG.BAT in Figure 2 is a slightly expanded version of the logging batch file above, one that you could modify to log all your use of the computer. In this example, there are four two-letter codes for programs, two for business and two for fun. LOG.BAT records start and end times for each of these programs. To insert a real application in place of the dummy ECHO statements, just enter the program name.

If the program can take command line parameters, add them after the program name: WP %2 %3 %4, for example. Remember to start with %2, since %1 is the program code. Then the command LOG WP BUSINESS.DOC would load the file BUSINESS.DOC into your word processor and automatically log the time you spent working on it.

This method *does* keep the disk spinning, what with creating the zero-length file, calling for a directory, filtering through FIND, writing to the log, and deleting the file. You'll notice a certain hesitation when you start your programs. If you have a RAMdisk, create both the START and END files on it—that will speed things up.

QB.BAT COMPLETE LISTING

```
ECHO OFF
CD\
TYPE START.QB > START.QB
DIR C:\START.QB | FIND "START" >> C:\RECORDS\QB.LOG
DEL START.QB
CD\QB45
QB
CD\
TYPE END.QB > END.QB
DIR C:\END.QB | FIND "END" >> C:\RECORDS\QB.LOG
DEL END.QB
```

Figure 1: This batch file logs the time spent working in QuickBASIC. You can easily adapt it to keep track of the time you spend working with other applications.

LOG.BAT COMPLETE LISTING

```
ECHO OFF
SET TYPE=
IF "%1"=="" GOTO Syntax
FOR %%v IN (WP SS wp ss) DO IF %1==%%v SET TYPE=BIZ
FOR %%v IN (DD FS dd fs) DO IF %1==%%v SET TYPE=FUN
IF "%TYPE%"=="" GOTO Syntax
REM > START_%1.%TYPE%
DIR START_%1.%TYPE% | FIND "START_" >> C:\RECORDS.LOG
DEL START_%1.%TYPE%
GOTO %1
:WP
ECHO Your WordProcessor here
PAUSE
GOTO endlog
:SS
ECHO Your Spreadsheet here
PAUSE
GOTO endlog
:DD
ECHO Your Dungeons 'n Dragons here
PAUSE
GOTO endlog
:FS
ECHO Your Flight Simulator here
PAUSE
:Endlog
REM > END___%1.%TYPE%
DIR END___%1.%TYPE% | FIND "END___" >> C:\RECORDS.LOG
DEL END___%1.%TYPE%
ECHO _____ >> C:\RECORDS.LOG
GOTO End
:Syntax
ECHO Syntax: "LOG NN", where NN is one of WP, SS, DD, FS
ECHO   WP=Word Processing
ECHO   SS=Spreadsheet
ECHO   DD=Dungeons 'n Dragons
ECHO   FS=Flight Simulator
:End
```

Figure 2: You can use this batch file as a model for a system that logs *all* of your computer usage.

SCHEDULING AUTOMATIC BACKUPS

If you're like me, either you don't use your computer every day, or you simply don't want to go through a backup of your data files each time you use your system. Here is a simple way to have your AUTOEXEC.BAT back up your data files every fifth time you start your computer.

The batch lines in Figure 3 check for the existence of five zero-length files. Depending on which files exist, the routine either renames the existing files or backs up the system's data directory.

In this example, the routine changes to the DOS directory (of course, you could use any subdirectory) and checks which COUNT files exist: COUNT5, COUNT4, COUNT3, COUNT2, or COUNT1. These are just marker files, and since they have zero length, maintaining them in a subdirectory sacrifices no disk space.

If any marker file except COUNT5 exists, the routine increments the count by renaming the files, then returns control to AUTOEXEC.BAT. If COUNT5 exists, the routine backs up the files in the DATA directory and resets the count by renaming the marker file.

To use this routine, first add the lines from Figure 3 to your AUTOEXEC.BAT using a text editor. Then create a zero-length marker file called COUNT1. You can do this by entering REM > COUNT1 at the DOS prompt. When finished, the routine will back up your system every five times you boot it.

If you want the routine to back up your system less often, modify the routine to check for a higher marker file. For instance, if you want the routine to back up after eight boots, change it to back up when COUNT8 exists, and add IF EXIST lines for COUNT5, COUNT6, and COUNT7. Note that you must always check from high to

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User-to-User

BACKUPX.BAT COMPLETE LISTING

```
@ECHO OFF
CD\DOS
IF EXIST COUNT5 GOTO BACKUP
IF EXIST COUNT4 RENAME COUNT4 COUNT5
IF EXIST COUNT3 RENAME COUNT3 COUNT4
IF EXIST COUNT2 RENAME COUNT2 COUNT3
IF EXIST COUNT1 RENAME COUNT1 COUNT2
GOTO DONE
:BACKUP
CLS
ECHO ** PUT BACKUP DISK IN DRIVE B: **
PAUSE
BACKUP C:\DATA\*.*  B:\
RENAME COUNT5 COUNT1
CD\
:DONE
```

Figure 3: Add these lines to your AUTOEXEC .BAT file, and you'll automatically back up your data every fifth time you turn on the computer.

low; otherwise one line will create the file the next line is looking for.

Charles J. Williams, Jr.
Virginia Beach, Virginia

In this column, we've given you batch files that activate just once a day, or on a particular day of the week, or at a particular time. All of these files assume you use your computer every day. If a particular system gets only occasional use, you need a different sort of batch file. A zero-length file is just the thing for tracking, since it uses no disk space besides its 32-byte directory entry.

To suspend your "every so often" action temporarily, just delete the COUNT file. When you want to start it again, give the command REM > COUNT1 to recreate the file.

MERGING PROGRAMS AND DOCUMENTATION

PC Magazine's DR.COM (Programming/Utilities, August 1987) is one of my most-used utilities because it allows viewing of all file types. It's interesting to look at the guts of programs and DOS commands. I almost always discover something I didn't know about these programs by seeing all their different messages at once.

I've accumulated a large number of programs, but since I use them only occasionally, it is difficult to remember their exact syntax, parameters, and switches. Many of the programs have instructions embedded within, and I use DR to review them, but others require a tedious search through the manual. I came up with an easy way to add my own notes and comments to any .COM or .EXE file without affecting how it runs. Weeks or months later I can view these notes with DR.COM to jog my memory.

Let's say you want to add some instructions to the program ASSIGN.COM. The easiest way is to use a batch file such as NOTES.BAT (Figure 4) to insert the comments automatically. Note that each line is successively appended to ASSIGN.COM using ECHO and the redirection command >>.

You can't use angle brackets (<>) within your comments when using this method. Instead use curly brackets ({ }) with the understanding that they really mean angle brackets. The piping sign (|) can't be used either.

Of course this method would quickly become tedious if you wanted to add more than just a few lines of text to a program file. To insert pages of documentation, you can concatenate a program file with a documentation file. The documentation file can either be one you prepare yourself or one that accompanied the program, just as long as it's a pure ASCII file.

NOTES.BAT COMPLETE LISTING

```
ECHO Notes:>>assign.com
ECHO This program redirects read/write requests>>assign.com
ECHO  from one or more drives to another drive.>>assign.com
ECHO Example: assign a=c b=c  (Requests to read/write>>assign.com
ECHO  to drives A/B will be redirected to drive C).>>assign.com
ECHO To disable, enter assign without parameter, or reboot.>>assign.com
```

Figure 4: You can use DR.COM or any other program that allows viewing of binary files to look at the usage instructions this batch file adds to ASSIGN.COM.

Assume you want to combine two files, CURSOR.COM and CURSOR.DOC, which respectively contain 152 and 745 bytes. The syntax to enter at the DOS prompt is

```
COPY /B CURSOR.COM+CURSOR.DOC
 CURSOR.COM
```

The /B means that the files will be treated as binary files; if you omit it, you'll trash the files. After you issue this command, the documentation will be an integral part of CURSOR.COM, and you may erase CURSOR.DOC. Whenever you want to view the documentation, use DR.COM to browse through CURSOR.COM.

There are other advantages to combining files, such as reducing disk clutter. In the above example, the gain is one cluster. Even the smallest file automatically takes one cluster (usually 1K, 2K, or 4K) of disk space. Combining the two files of 152 and 745 bytes yields a single file of 897 bytes, using only one cluster instead of two as for the original two files.

I regularly use both methods to add notes to .COM and .EXE files, and have encountered no problems running the programs later.

R. Vaillancourt
Kingston, Ontario
Canada

For most small utilities, you *probably* won't do any harm by appending the documentation to the program. The program will simply execute as usual and end when it reaches its final command. But do be cautious using this technique, especially with RAM-resident utilities (TSRs). It's conceivable you could end up loading the appended documentation into RAM along with your utility, thus wasting RAM. Always save an unmodified copy *somewhere*, if only on a backup floppy, in case problems arise.

If you do try this on TSR programs, note how much RAM they take before and after the change. The DOS 4.0 MEM /PROGRAM command shows you each program's size, or you can use one of the many memory-mapping utilities such as *PC Magazine*'s PCMAP. If these options aren't available, run CHKDSK before and after loading the program and calculate its memory use by the difference in the "bytes free" figure. If the RAM usage increases, don't use the program—replace it with the unmodified backup.

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Previous Address: **Dates of Residence:** From To

Your Employer: (If self employed see rear panel) **Date of Employment:** Mo Yr **Position:** **Monthly Income:** Gross $ Net $

Employer's Address: Street City State **Business Phone:** ( ) –

Previous Employer: **Address:** **Dates of Employment:** From To

Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as a basis for repaying this obligation

Other Income: – I have received since (Date) **Monthly Income** Gross $ Net $

Name and Address of Nearest Relative Not Living With You **Relationship**

b. Credit Information

Include joint applicant's information, if joint account requested

	Bank Name	Address		
Bank Account:			☐ Checking ☐ Savings	
Bank Account:			☐ Checking ☐ Savings	
Bank Loan Reference:			Payment	Balance
Bank Card Reference: VISA Mastercard				
Other Credit Card Reference				
Other Credit References:	Account No.	Expires		

Driver's License No. State Expires

c. Joint Applicant's Personal Information

If you are a married Wisconsin applicant, you must provide your spouse's information below, even though your spouse may not be signing this contract

Joint Applicant's Name: First Initial Last **Date of Birth:** Mo Day Yr **Social Security Number:**

Address Street Apt # City State Zip **Date of Residence:** Mo Yr **Home Phone** ( ) –

Employer: **Date of Employment:** Mo Yr **Position:** **Monthly Income:** Gross $ Net $

Employer's Address: Street City State **Business Phone:** ( )

d. Self-Employed Information

Complete this section only if you are self employed

Business Name	Proprietorship Corporation Partnership	
Business Address		Business Telephone ( )
Description of Business	Your Position	In Business Since
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edited by
Craig L. Stark

Power User

- **SEARCH AND DELETE—A NEW TWIST:** A simple macro that lets you search for and delete text formatted in a given style.
- **MIXING dBASE FIELDS:** Combining different fields to save disk space can be counterproductive.
- **A TIP FOR MACRO PROGRAMMING:** Surprise! WordPerfect 5.0 variables accept commands.

SEARCH AND DELETE—A NEW TWIST

The Esc Replace command in *Microsoft Word*, Versions 4.0 and 5.0, will let you search for specified text and either replace it with other text or delete it. The Esc Format repLace Style command is similar in that it will let you search for a specified style and replace it with another style. What is missing is an easy way to search for a style and delete the text formatted with that style. Such a command would be useful when you need to create a version of a file with all hidden or strikethrough text removed, for example, or a version that removes all paragraphs formatted as headings.

The macro in Figure 1 takes advantage of the Esc Format sEarch command to add this search-and-delete capability to *Word*. The macro prompts for the style to search for, gives you the option to confirm each deletion or not, then goes to the beginning of the document and starts the search. Note that the macro will find only stylesheet-based formats, so that it will not work if you have formatted the text directly.

Stephen H. Skiles
Battle Creek, Michigan

PC MAGAZINE This search-and-delete macro can indeed be useful. However, keep in mind that it is not necessary to remove text if you only want to keep that text from printing. For example, suppose you want to avoid printing text that has been formatted as strikethrough on your stylesheet. You can go to the Gallery and change the format of the style to hidden text. As long as hidden text is set to No on the Print Options menu, anything formatted in that style will not print.

Also note that although stylesheets unquestionably give you more control over your format, you can build a similar macro to search for and delete text that has been formatted directly. To search for character formats, eliminate the first line of the macro in Figure 1; this line asks for the style to be deleted. Then change the third line to

```
<Ctrl PgUp><Ctrl Esc>fecd«pause»
<Enter>
```

This calls the Esc Format sEarch Character menu, then pauses so you can define the character format for which it's to search. You can also search for and delete directly formatted paragraph formats by changing the third line to

```
<Ctrl PgUp><Ctrl Esc>fepd«pause»
<Enter>
```

instead. This variation calls the Esc Format sEarch Paragraph menu, then pauses for you to define the paragraph format for which it's to search.—*M. David Stone*

SEARCH-AND-DELETE MACRO — **COMPLETE LISTING**

```
«SET delsty = ?Style to be deleted.»
«SET prompt = ?Confirm deletions Y/N»
«IF prompt = "n"»«SET prompt = "N"»«endif»
«IF prompt = "y"»«SET prompt = "Y"»«endif»
<Ctrl PgUp><Ctrl Esc>fes«delsty»<Tab>d<Enter>
«WHILE FOUND»
«IF prompt = "Y"»«SET delet = ?Delete Y/N»
«IF delet="y"»«SET delet="Y"»«endif»
«IF delet="Y"»<del>«ELSE»<Right>«ENDIF»
«ELSE»
<Del>«ENDIF»
<Left><Shift F4>
«ENDWHILE»
```

Figure 1: This macro for *Microsoft Word*, Versions 4.0 and 5.0, searches for text formatted in a given style, then deletes the text. Note that it gives you the option of confirming the deletions.

MIXING dBASE FIELDS

I keep a large mailing list of residences and businesses. To save disk space, I've combined the last name and company fields; if the record is a business, the company name goes in the Lname field and the Fname field is left empty.

But this creates a problem with mailing labels, because even if the Fname field is TRIMmed, there is a space between Fname and Lname, and it appears to the left of every company label. To correct this, I use both of *dBASE*'s TRIM functions in the Label Form's first line; for example,

```
LTRIM(TRIM(Fname)+" "+Lname)
```

Gary M. Ciborowski
Perry Hall, Maryland

PC MAGAZINE This is a good solution to a problem that shouldn't exist, since it's generally bad practice to mix different entities (like company and last name) in a single field. Suppose you suddenly need to make personalized mailings to such a file? What if a record needs *both* a company and a last name? Then, too, com-

pany names tend to be much longer than last names, so some disk space is wasted in the combined field, anyway.

A better solution is to expand the structure to include separate company and last name fields. The residential records will have an empty Company field, while business records will have empty Lname and Fname fields.

To produce an alphabetical listing, you then create a conditional index, as follows:

```
INDEX ON IIF(company>" ",
company,lname)
```

This works in all *dBASE* versions and clones starting with *dBASE III Plus*. You can get around SORT's inability to deal with conditional expressions by performing the INDEX command and then COPYing the file while the index is active. The Label Form's first line would be

```
IIF(company>" ",company,;
LTRIM(TRIM(Fname)+" "+Lname))
```

In other words, if there's anything in the Company field, print that; otherwise, print the Lname and Fname fields.

If you must keep both Company and LastName in the same field, here are a couple alternatives that allow better sorting. The first is to add a 1-byte code field to distinguish companies from residences. The second involves entering business names in uppercase and residences in upper- and lowercase. Then you can distinguish between the two types by testing whether Lname=upper(Lname).

If a company name is prefaced by an article or something that would spoil its alphabetical sequence, either alternative will let you hold it in Fname. For example, The Brown Company should not be sorted with the Ts; so in this case, The would be put in the Fname field so that the record would be sorted on Brown Company.—*Brad Stark*

A TIP FOR MACRO PROGRAMMING

While developing a macro-based application for a client, I had to create unique filenames for a series of closely related, very similar files. And because DOS filenames are seldom long enough to be informative, the hard copy document was to be *branded* with the filename of the document.

UNIQUE.WPM — **COMPLETE LISTING**

```
{;}Change·the·format·of·the·date·string·to·the·end·of·the·filename~
{Date/Outline}f%2%1%7.%9{Enter}{Enter}
{;}Set·var2·to·accept·the·new·filename·(wild·indirection·here)~
{ASSIGN}1~{Macro Commands}31~
{;}Now·that·var1·holds·the·commands·to·accept·material·from·document~
{Date/Outline}1{Block}{Home}{Left}{VAR 1}
{;}Reset·the·date·format·to·normal~
{Date/Outline}F3·1,·4{Enter}{Enter}
{;}Save·the·file·with·new·unique·file·name~
{Save}{VAR 1}{Enter}
{;}DONE!!!!~
```

Figure 2: UNIQUE.WPM saves the current file under a unique filename and the filename of the document on the hard copy.

UNIQUE.WPM, shown in Figure 2, demonstrates how I did this, as well as showing an absurd limitation of *WordPerfect* macros.

For the purpose of this project, a unique filename consists of a single character indicating the type of document followed by pairs of digits representing (in order) the year, month, day, hour (24-hour clock), and minute. Getting the date and time information for branding the file is simple enough with the date text function. However, naming the file requires putting *all* the information into a macro variable, which requires indirection. The macro assumes that the cursor is located at the end of the document-type character portion of the filename and that nothing else exists on the same line as the filename.

The first line of UNIQUE.WPM changes the date format into one usable as the last characters and extension of the filename. The second assigns to the macro variable 1 keystroke that enters a block of characters from the document into a macro variable *if a macro weren't running*.

The macro next appends the date portion of the filename to the single character and blocks the whole filename. It then expands the macro variable, which puts the whole block of text into the same variable. It saves the file, with the expansion of the variable providing the filename.

I suspect that the *WordPerfect* 5.0 macro language is one of the computer languages that is not quite sure what is data and what is program. I am sure that some readers will be able to exploit this feature in some truly remarkable ways.

Thompson Freeman
Charlotte, North Carolina

WordPerfect 5.0 variables supposedly hold just text and codes. How amazing to find that they can hold commands, as well. Mr. Freeman calls this fact an "absurd limitation." I call it an opportunity, and the example macro proves my point.

Each time you run UNIQUE.WPM, it saves your document under a different name. You'll use a lot of disk space that way, but you'll also have an audit trail of document changes. The current name remains in {VAR 1}, unless some other macro changes it. You could edit UNIQUE.WPM to insert the contents of {VAR 1} into a header or document summary before saving the document.

For a less complex example that puts commands in a variable, create a macro like this one:

```
{ASSIGN}1~{List Files}{Enter}~
{VAR 1}
```

The first line assigns the two keys F5 (List Files) and Enter to variable 1. The second line simply inserts variable 1 into the text. The commands take effect just as if you were typing them.

It should be possible to simplify certain macros that require lots of IF or CASE tests using this technique. Rather than test many separate options, simply build up the appropriate set of commands in a variable and then execute that variable. I'll be interested to see how readers use this technique.—*Neil J. Rubenking*

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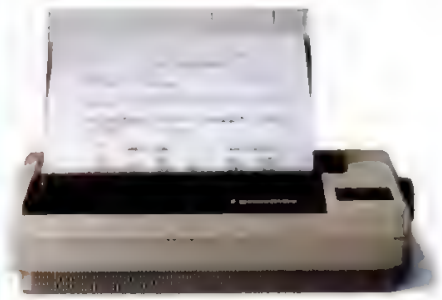

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CIRCLE 321 ON READER SERVICE CARD

edited by
Tony Rizzo

Languages

CREATING REALLY TINY TURBO C .COM FILES

Creating truly tiny programs usually requires the use of assembly language. Though C is very efficient, as far as high-level languages go, even a simple C program like

```
main(void)
     {
     puts("Hello, world");
     }
```

will create a 4,262-byte .COM file using the Turbo C Tiny memory model. This .COM file will include the startup code for preparing command line arguments and other facilities that this program doesn't use.

Because I wanted to create some very tiny programs, I began to modify the startup code for the Tiny memory model, which resulted in TEENY.ASM, shown in Figure 1. The source is assembled with TASM or an equivalent assembler into an object file with the name C0T.OBJ.

To my surprise, I discovered that this memory model requires hardly any code at all. The startup code only needs to define the segments and groups, as well as reserve 256 bytes for the Program Segment Prefix. You will need to make sure that you place main() at the beginning of your source file, so that you will not need a jump instruction to get the program started.

- **CREATING REALLY TINY TURBO C .COM FILES:** Use the new startup code provided here to eliminate unneeded .COM file overhead.
- **GOTO ENHANCEMENT FOR TURBO PASCAL:** Turbo Pascal's GOTO statement is restricted to the current procedure. These routines remove that restriction.
- **SIMULATING BREAKPOINTS:** Here's how to emulate Turbo Debugger breakpoints under the Turbo Pascal Integrated Environment.

Since DOS pushes its own return address on the stack, you can exit the program simply by issuing a return from main().

There are a few limitations and caveats in this system. You cannot use the standard I/O library calls (like puts() or int86()), but you can still use bdos() (for DOS services) and in-line assembly language to access the ROM-BIOS services.

Using this new C0T.OBJ, a "Hello, world" program might look like

```
main(void)
     {
     bdos(9, "Hello, world\r\n$");
     }
```

When compiled and linked with the new C0T.OBJ and EXE2BIN'ed, the resulting .COM file is only 52 bytes long. An alternative version (which requires TASM) takes only 24 bytes:

```
main(void)
  {
  _DX = (int) "Hello, world\r\n$";
  _AH = 9;
  asm int 021h;
  }
```

I couldn't do much better than that in straight assembly language.

Philip J. Erdelsky
San Diego, California

If you are willing to give up some of the services provided by the Standard Library, C can become a high-level assembler in the real sense of the word. It's too bad we can't modify the compiler to create a new memory model that would use this startup code file.

The new startup code, TEENY.ASM, must be assembled to create a new C0T.OBJ. But make sure to rename and save the original C0T.OBJ file first. Then you should replace C0T.OBJ in your TC library directory. Or you can use the -L command-line option to create a new path to it:

```
tcc -mt -L.\ hello3.c
```

if the file is in the current directory.

Be sure to use the -mt option on the command line or select the Tiny model in the TC integrated environment.—*Richard Hale Shaw*

TEENY.ASM — **COMPLETE LISTING**

```
; Tiniest C Startup code for Turbo C 2.0 Tiny Model

_TEXT      SEGMENT BYTE PUBLIC 'CODE'
_TEXT      ENDS
_DATA      SEGMENT WORD PUBLIC 'DATA'
_DATA      ENDS
_BSS       SEGMENT WORD PUBLIC 'BSS'
_BSS       ENDS

DGROUP     GROUP       _TEXT, _DATA, _BSS

_TEXT      SEGMENT
           ORG         100H
BEGIN:
_TEXT      ENDS

           END         BEGIN
```

Figure 1: New startup code for Turbo C 2.0's Tiny model results in significantly smaller .COM files.

GOTO ENHANCEMENT FOR TURBO PASCAL

Two of the most useful functions available to the C programmer are `setjmp` and `longjmp`. Together they allow you to perform a nonlocal GOTO statement—a jump between functions instead of a jump within a function. This is useful in cases like error handling, where you might want to return to an outer level in a series of deeply nested functions. The ISO Pascal standard also provides a similar capability with the GOTO statement. Unfortunately, Turbo Pascal restricts the destination of GOTO statements to the current block.

To get around this limitation, I wrote a Turbo Pascal unit called JUMP.PAS (see Figure 2), that implements Pascal equivalents of the C functions `SetJmp` and `LongJmp`. `SetJmp` stores its return address, stack segment, and pointer, the current frame pointer, and the current data segment in a record called a `JmpBuf`. These are the only registers that must be preserved between function calls, according to the Turbo Pascal documentation. After saving the current context, `SetJmp` then returns a value of 0. When `LongJmp` is called with a `JmpBuf` as an argument, it takes these values and returns to the procedure or function that called `SetJmp` in the first place.

> You can arrange to return from any level of nested procedures without any GOTOs, local or otherwise, if you plan in advance.

There is one difference between returning from `SetJmp` and returning from `LongJmp`: a nonzero value is returned from the call to `LongJmp`. This value can be used to determine an error number, or simply to distinguish whether the return was from `SetJmp` or `LongJmp`.

The assembly code for `SetJmp` and

JUMP.PAS — COMPLETE LISTING

```
{ Non - local Goto for Turbo Pascal 4.0 }
UNIT Jump;
INTERFACE
TYPE
  JmpBuf = RECORD
             SP : Word;
             SS : Word;
             CS : Word;
             IP : Word;
             BP : Word;
             DS : Word;
           END;

  { Save current context and return a code of 0 }
FUNCTION SetJmp(VAR X : JmpBuf) : Integer;

  { Restore context and return the given code }
PROCEDURE LongJmp(VAR X : JmpBuf; RetValue : Integer);

IMPLEMENTATION
  FUNCTION SetJmp; EXTERNAL;
  PROCEDURE LongJmp; EXTERNAL;
  {$L SETJMP.OBJ }
END.
```

Figure 2: Source code listing for JUMP.PAS, which implements Pascal equivalents of the C functions SetJmp and LongJmp. Use the Unit resulting from this code to enable nonlocal GOTOs.

SETJMP.ASM — COMPLETE LISTING

```
CODE    SEGMENT BYTE PUBLIC
        ASSUME CS:CODE
        PUBLIC SetJmp, LongJmp

SetJmp  PROC FAR
        PUSH    BP
        MOV     BP, SP
        LES     DI, 6[BP]       ; Get address of JumpBuffer
        CLD
        LEA     AX, 6[BP]       ; Save SP
        ADD     AX, 4
        STOSW
        MOV     AX, SS
        STOSW                   ; Save SS
        MOV     AX, 4[BP]
        STOSW                   ; Save CS
        MOV     AX, 2[BP]
        STOSW                   ; Save IP
        MOV     AX, [BP]
        STOSW                   ; Save BP
        MOV     AX, DS
        STOSW                   ; Save DS
        XOR     AX, AX          ; Return a value of 0 from SetJmp
        POP     BP              ; Restore previous frame pointer
        RET     4               ; Clean up stack and return
SetJmp  ENDP

LongJmp PROC    FAR
        PUSH    BP
        MOV     BP, SP
        MOV     BX, 6[BP]       ; Get the return code
        CMP     BX, 1   ; If it is zero then return a value of 1
        ADC     BX, 0   ;       so that LongJmp never returns 0
        LDS     SI, 8[BP]       ; DS:SI points to JumpBuffer
        CLD
        LODSW           ;Restore SS
        MOV     SS, [SI]
        MOV     SP, AX  ;Restore SP
        LODSW
        LODSW
        PUSH    AX      ;Push CS and IP onto the stack
        LODSW
        PUSH    AX
        LODSW
        MOV     BP, AX  ;Restore BP
        LODSW
        MOV     DS, AX  ;Restore DS
        MOV     AX, BX  ;RetValue in AX
        RET             ;Return with CS:IP from JumpBuffer
LongJmp ENDP
CODE    ENDS
        END
```

Figure 3: Source code listing for SETJMP.ASM. SETJMP.ASM must be assembled into SETJMP.OBJ, which is needed by JUMP.PAS to create JUMP.TPU.

LongJmp that is necessary for creating SETJMP.OBJ, which is needed by JUMP.PAS, is listed in Figure 3. To create the file JUMP.TPU, use the following commands:

```
MASM SETJMP.ASM;
TPC JUMP.PAS
```

A simple example program illustrating the usage of SetJmp and LongJmp is shown in Figure 4.

James J. Hankinson
Edmonton, Alberta
Canada

Pascal pundits abhor the GOTO statement—it's too conducive to the "spaghetti code" that structured programming is supposed to eliminate. And, of course, the worst GOTO is a nonlocal GOTO. But in fact there are occasions when it is useful. The most common one, as the author mentions, is to return from a deeply nested series of procedures to an error handling routine.

JUMPTEST.PAS — **COMPLETE LISTING**

```
PROGRAM JumpTest;
USES Jump;
VAR
  JumpBuffer : JmpBuf;
  RetValue : Integer;
  X : Integer;

  PROCEDURE A;
  BEGIN
    WriteLn('In Procedure A');
    IF X = 1 THEN
      LongJmp(JumpBuffer, 1)
      { Return to outer level with RetValue = 1 }
    ELSE
      BEGIN
        X := X+1;
        WriteLn('Returning from A');
      END;
  END;

  PROCEDURE B;
  BEGIN
    WriteLn('In Procedure B');
    A;
    WriteLn('Returning from B');
  END;

BEGIN
  X := 0;
  REPEAT
    RetValue := SetJmp(JumpBuffer);
    IF RetValue = 0 THEN
      B
    ELSE
      WriteLn('Exit with RetValue = ', RetValue);
  UNTIL RetValue <> 0;
END.
```

Figure 4: Source code listing for JUMPTEST.PAS, a simple program that exercises the SetJump and LongJump calls made available in JUMP.TPU.

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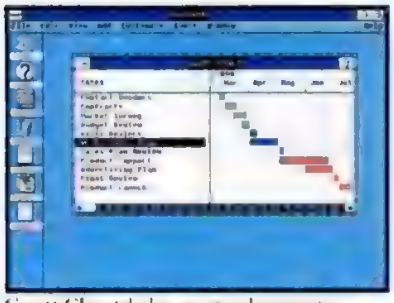

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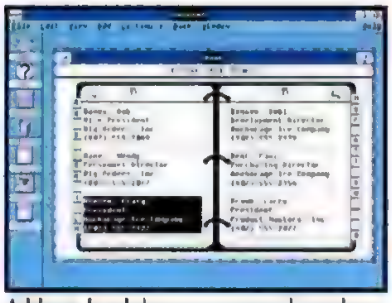

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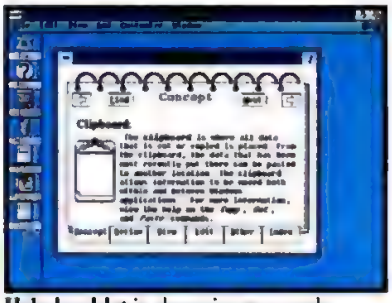

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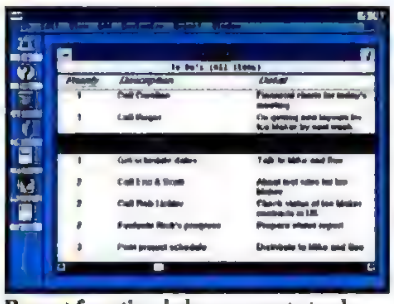

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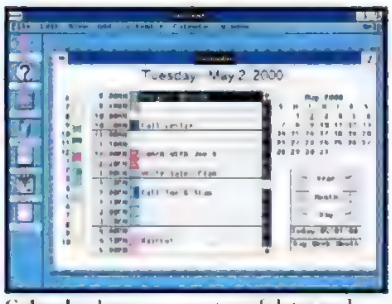

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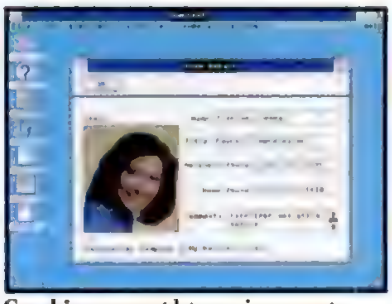

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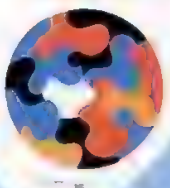

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SETJMP.PAS — **COMPLETE LISTING**

```
{*       Copyright (c) TurboPower Software 1987.       *}
TYPE
  JumpRecord =
    RECORD
      SpReg, BpReg : Word;
      JmpPt : Pointer;
    END;

  PROCEDURE SetJump(VAR JumpDest : JumpRecord);
    {-Save current SP, BP, and a jump destination}
  INLINE(
     $5F/                {pop di             ;di = Ofs(JmpDest)}
     $07/                {pop es             ;es = Seg(JmpDest)}
     $26/$89/$25/        {mov es:[di],sp     ;save sp}
     $26/$89/$6D/$02/    {mov es:[di+2],bp   ;save bp}
     $E8/$00/$00/        {call null          ;push IP onto stack}
     {null:}
     $58/                {pop ax             ;pop into ax}
     $05/$0C/$00/        {add ax,12          ;point to "next:"}
     $26/$89/$45/$04/    {mov es:[di+4],ax   ;save jump offset}
     $26/$8C/$4D/$06);   {mov es:[di+6],cs   ;save jump segment}
  {next:}

  PROCEDURE LongJump(VAR JumpDest : JumpRecord);
    {-Restore SP, BP, and jump to JumpDest.JmpPt}
  INLINE(
     $5F/                {pop di             ;di = Ofs(JumpDest)}
     $07/                {pop es             ;es = Seg(JumpDest)}
     $26/$8B/$25/        {mov sp,es:[di]     ;restore sp}
     $26/$8B/$6D/$02/    {mov bp,es:[di+2]   ;restore bp}
     $26/$FF/$6D/$04);   {jmp far es:[di+4]  ;jump far to JumpDest.JmpPt}
```

Figure 5: SETJUMP.PAS provides a different implementation of the setjump/longjump functions that utilizes INLINE directives. This eliminates the need for separate assembly language source code (and therefore, of course, eliminates the need for MASM).

You can arrange to return from any level of nested procedures without any GOTOs, local or otherwise. You just have to plan in advance and write your procedures in a particular way. Every procedure becomes a Boolean function looking something like

```
FUNCTION
Sample(X,Y,Z:Byte):Boolean;
BEGIN
  Sample := FALSE;
  IF NOT Sample1(X,Y) THEN Exit;
  IF NOT Sample2(Z) THEN Exit;
  Sample := TRUE;
END;
```

You can nest such procedures as deeply as you want. If at any point one of them fails, it will return FALSE. The FALSE result will propagate back up the chain of function calls—at each level it will cause the current function to exit immediately, thereby returning its own value as FALSE. Only if the function completes all of its subfunctions successfully does it return TRUE.

You will need MASM to assemble the ASM source in Figure 3. If you don't have it, don't despair. Figure 5 provides a different implementation of `setjump` and `longjump`, this time around as INLINE directives. Note that this version doesn't need to save the stack segment or data segment. Thanks go to TurboPower Software for these two INLINE procedures.—*Neil J. Rubenking*

SIMULATING BREAKPOINTS

The standalone Turbo Debugger has powerful breakpoint features that are lacking in the Turbo Pascal 5.0 debugger. It is possible, however, to provide at least some of the Turbo Debugger breakpoint functionality in the Turbo Pascal environment.

Let's assume that you are looping through an array of 200 elements and you would like to set a breakpoint when the index becomes greater than 100. This can be accomplished under the Turbo Pascal environment by using the following code:

```
IF condition THEN
     dummy statement;
```

and putting a breakpoint on the dummy statement. Note that the dummy statement must be on the line below the conditional.

Jud McCranie
Valdosta, Georgia

The debugger that's part of the Turbo Pascal 5.0 Integrated Development Environment (IDE) has only one kind of breakpoint. When a program running under the IDE reaches a line containing a breakpoint, it pops back to the IDE. At this point, you can evaluate variables or expressions, set "watches" to observe variable contents, and single-step through the program.

That's great, but the standalone Turbo Debugger gives you much more breakpoint power. You can set a breakpoint to pop into the debugger any time a given variable changes or whenever a certain expression becomes true. These conditional breakpoints can be tied to a single line, or they can be global throughout the program. Pass count breakpoints are triggered after they've been executed a certain number of times. Even though the Integrated Development Environment doesn't have these features, it is possible to provide fair emulations of some of them.

The example provided by Mr. McCranie is a template for a simple conditional breakpoint. When the condition is true, the dummy statement is executed and activates the breakpoint. What kind of dummy statement should you use to activate the breakpoint? You can't use an empty statement (a line with just a semicolon on it). X:=X; will certainly work, or IF TRUE THEN;.

If you're going to employ this technique frequently, you will want to use a real no-operation. Define a tiny INLINE directive `PROCEDURE Nop; INLINE($90);` and use "nop" for your dummy statement. "Nop" takes only 1 byte of code space—you can't get smaller than that.

To simulate a pass count breakpoint, one that will activate after a certain number of passes, you'll need a counter variable. For example, this procedure contains a breakpoint that activates every tenth time the procedure is called.

```
PROCEDURE foo;
CONST X : Byte = 0;
BEGIN
  IF X=10 THEN
    X := 0; {<== breakpoint here}
  Inc(X);
  {rest of procedure}
END;
```

The global breakpoint that activates when a particular variable gets changed is handy for tracking program bugs that trash

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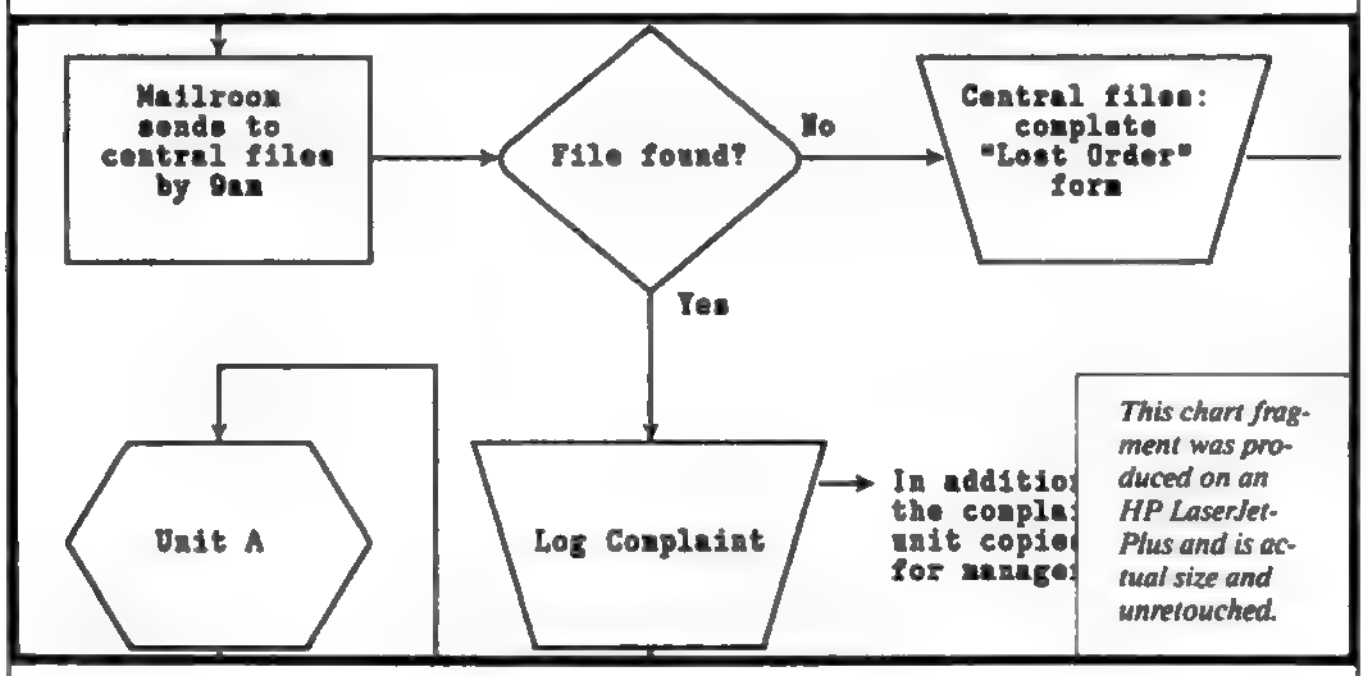

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CIRCLE 201 ON READER SERVICE CARD

memory. Uninitialized pointers are often the culprits in such a case. Letting Move, FillChar, or BlockRead overrun the size of the buffer variable is another common cause. You can't duplicate the global type of breakpoint, but you can come close by scattering test code throughout your program. The code to accomplish this might look like the following:

```
IF MyVar <> OldMyVar THEN
     nop; {<== breakpoint here}
```

Every time you legitimately change the value of MyVar, you will have to set OldMyVar to the same value. If it changes any other time, you've caught the bug in action.

When you're not working on debugging your program, you don't need the added variables and tests that are shown above. In order to avoid wasting code space on them, you'll want to surround them with conditional compilation directives and enable them only when you're debugging. Rewriting the example procedure above, we have

```
PROCEDURE foo;
{$IFDEF CondBreak}
   CONST X : Byte = 0;
   BEGIN
   IF X=10 THEN
        nop; {<== breakpoint here}
        Inc(X);
   {$ELSE}
        BEGIN
   {$ENDIF}
   {rest of procedure}
     END;
```

To enable debugging, just insert {$DEFINE CondBreak} at the top of the program.—*Neil J. Rubenking*

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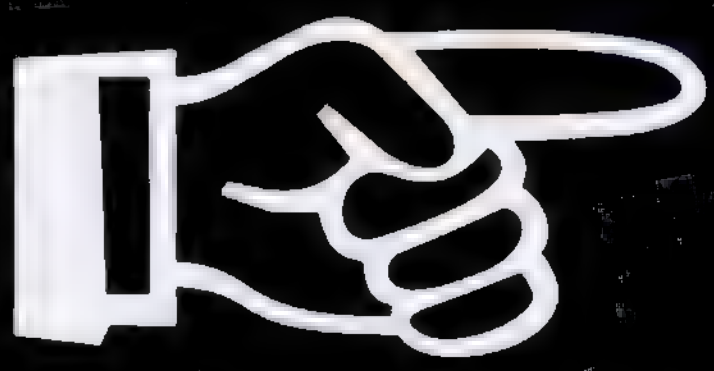

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CIRCLE 263 ON READER SERVICE CARD

edited by
Tony Rizzo

Tutor

EXPANDED VS. EXTENDED MEMORY

I understand why expanded memory is an attractive standard to write to for software developers, since there are multitudes of 8086/8088-based PCs for which extended memory isn't an option. But why do developers often recommend that RAM beyond 1MB on 80286 and 80386 machines be configured as expanded memory rather than extended? Isn't using the direct access obtained with extended memory faster and more efficient than dealing with banks of expanded memory?

Joel Samoff
Palo Alto, California

- EXPANDED VS. EXTENDED MEMORY: Why is expanded memory still the memory management standard most supported by popular software?
- MAKING SENSE OF HARDWARE INTERRUPTS: How external devices grab the CPU's attention.

PC MAGAZINE Yes, extended memory is faster; but it is also less structured. The EMS 4.0 specification is a widely accepted standard for dealing with bank-switched RAM; it allows programs to allocate and deallocate memory outside the confines of DOS. The expanded memory manager makes sure that no two programs grab the same chunk of RAM. A RAM-disk sitting in expanded memory can be assured that its data won't be overwritten by a spreadsheet program that also uses expanded memory.

The same isn't true of extended memory. Until recently, there was no agreed-upon set of protocols to govern access to extended memory. Everything above 1MB was not unlike a big playground, open for any program to use virtually any way it wanted. The nearest thing to a standard was VDISK.SYS method for reserving portions of extended memory—allocating chunks from the bottom up and including a header that identified the location of the next block of free memory.

Still other programs (IBMCACHE .SYS, for one) allocated memory from the top down, hooking into interrupt 15h so that any program that called function 88h to get a reading on the amount of extended memory installed would receive a figure *x* bytes less than what was actually there, where *x* was the amount of RAM IBMCACHE had reserved for itself. Without an enforced standard, any program that used extended memory risked destroying data placed there by other programs.

Enter the Extended Memory Specification, or XMS, tendered by some of the same industrial partners who devised EMS 4.0. XMS brings the same sort of order to extended memory that EMS brought to expanded memory, with a uniform set of function calls that gives all application programs equal and arbitrated access to memory beyond the 1MB barrier (and to blocks of memory between 640K and 1MB that don't adjoin the first 640K of conventional memory) on 286 and 386 PCs.

For the more technically minded, Figure 1 contains a listing of the 18 functions defined in XMS 2.0. Functions 01h through 07h deal with the 64K block of memory at the base of extended memory known as the High Memory Area; this area can be accessed from real mode using the A20 address line on some 286 and 386 machines. Functions 08h through 0Fh are provided for managing blocks of extended memory. Blocks can be up to 65MB in

PC MAGAZINE **EXTENDED MEMORY SPECIFICATION (XMS) 2.0 FUNCTIONS**

Function	Description
00h	Get XMS Version Number
01h	Request High Memory Area
02h	Release High Memory Area
03h	Globally Enable Address Line A20
04h	Globally Disable Address Line A20
05h	Locally Enable Address Line A20
06h	Locally Disable Address Line A20
07h	Query Address Line A20
08h	Query Free Extended Memory
09h	Allocate Extended Memory Block
0Ah	Release Extended Memory Block
0Bh	Move Extended Memory Block
0Ch	Lock Extended Memory Block
0Dh	Unlock Extended Memory Block
0Eh	Get Handle Information
0Fh	Reallocate Extended Memory Block
10h	Request Upper Memory Block
11h	Release Upper Memory Block

Figure 1: XMS 2.0 defines 18 functions that give all applications equal and arbitrated access to memory beyond the 1MB boundary.

length. Functions 10h and 11h work with so-called Upper Memory Blocks—chunks of memory between 640K and 1MB that aren't contiguous with the lower 640K. Note the conceptual similarities to the Expanded Memory Specification, which also manages memory in block units through the use of a common driver serving all application programs.

XMS is not in wide use yet, but it's undeniably destined to be a key player in opening up the realms of extended memory to DOS users. If you want to explore it further, you can obtain a copy of the XMS specification and Microsoft's version of the XMS driver free of charge, complete with source code, by calling Microsoft's Information Center at (800) 426-9400.—*Jeff Prosise*

MAKING SENSE OF HARDWARE INTERRUPTS

What are hardware interrupts? Can you explain how hardware interrupts are managed on the PC? What's the meaning of terms such as IRQ3 and IRQ4, and what can one do when two or more boards want to use the same hardware interrupt?

Denis Hosking
Winnipeg, Manitoba
Canada

IRQ (Interrupt ReQuest) lines are simply physical connections between interrupt controllers and external devices that permit the latter to grab the attention of the CPU when they need it.

Interrupt requests on the PC are funneled through a chip called the 8259A Programmable Interrupt Controller, or PIC. One PIC can manage up to eight IRQ lines, prioritizing interrupts as they are received and passing them on one at a time to the CPU. By convention, the eight interrupt lines are labeled IRQ0 through IRQ7, with the lower-numbered interrupts demanding higher priority.

In the PC, IRQ0 and IRQ1 are dedicated to the system timer and the keyboard. Each time the countdown timer expires (about 18.2 times per second), an interrupt 8 is generated that transfers control to an interrupt service routine in the BIOS. This routine updates the PC's time-of-day clock and calls interrupt 1Ch to give user-installed programs the chance to perform time-critical tasks of their own.

Likewise, each press or release of a key triggers an interrupt 9 that signals the BIOS to read a scan code from the keyboard controller. The other six hardware interrupts—IRQ2 through IRQ7—are available to expansion boards installed in the I/O bus.

Additional interrupt controllers can support additional IRQ levels. While PCs and XTs contain a single 8259A, the AT has two. The INT line from the second one (the slave, responsible for IRQ levels 8 through 15) is hardwired to IRQ2 on the first (the master, which manages levels 0 through 7), providing users with a total of 16 hardware interrupt lines to choose from. Figure 2 shows IBM's suggested uses for the 8 IRQ lines in PCs and XTs and the 16 lines in ATs.

When an external device generates an interrupt, the 8259A checks its Interrupt Mask Register to make sure that interrupts on the corresponding IRQ line are enabled. If they are, and if another interrupt of equal or higher priority isn't being serviced, the 8259A notifies the CPU via the INTR line. Provided the interrupt flag in the CPU flags register is set, the CPU responds by pushing the contents of its flags register onto the stack followed by the contents of CS and IP. Then it acknowledges the interrupt on INTA and waits for the 8259A to place the interrupt number on the data bus.

Before the interrupt number is transmitted, the 8259A adds to it the value in its Offset Register (the default for the master interrupt controller is 8—hence the fact that IRQ0 corresponds to interrupt 8, IRQ1 to interrupt 9, and so on). The CPU uses the result as an index into the interrupt vector table stored in low memory. Execution is vectored to the address specified in the table and ends when an IRET instruction is executed. Until it is notified that interrupt processing is complete by receipt of an End of Interrupt (EOI) signal from the interrupt handler, the 8259A will continue to withhold equal- or lower-priority interrupts from the CPU.

Different boards use IRQ lines in different ways. A serial port, for example, can be programmed to trigger an interrupt when any one of several communications-related events occurs—when a character is received, when the UART is ready to output another character, and when a framing or parity error occurs, to name a few. Once an interrupt handler takes over, it can read the UART's Interrupt Identification Register to determine what triggered the interrupt. By contrast, a parallel printer port uses an IRQ line exclusively to tell the CPU that it is ready to accept another byte of data.

Well, this is certainly pretty technical stuff—but what does it mean to someone who's simply trying to install a new board in his PC? The goal is to configure expansion boards so that each one has its own IRQ line. Most boards have switches or jumpers that permit you to choose among several IRQ levels. If you're installing a network adapter, for example, you'll want to set its switches such that it doesn't interfere with any other adapter in the system. If you have a serial port, you know already that IRQ4 is taken. If you have two serial ports, so is IRQ3.

IRQ ASSIGNMENTS ON PCs, XTs, ATs, AND PS/2s

SINGLE INTERRUPT CONTROLLER (PCs AND XTs)

IRQ	Device	Interrupt No.
IRQ0	System timer	08h
IRQ1	Keyboard	09h
IRQ2	Reserved	0Ah
IRQ3	COM2 serial port	0Bh
IRQ4	COM1 serial port	0Ch
IRQ5	Fixed disk controller	0Dh
IRQ6	Floppy disk controller	0Eh
IRQ7	LPT1 parallel port	0Fh

DUAL INTERRUPT CONTROLLERS (ATs AND PS/2s)

IRQ	Device	Interrupt No.
IRQ0	System timer	08h
IRQ1	Keyboard	09h
IRQ2	INT line from slave 8259A	—
IRQ8	Real-time clock	70h
IRQ9	Redirected to IRQ2	71h
IRQ10	Reserved	72h
IRQ11	Reserved	73h
IRQ12	Mouse	74h
IRQ13	Math coprocessor	75h
IRQ14	Fixed disk controller	76h
IRQ15	Reserved	77h
IRQ3	COM2 serial port	0Bh
IRQ4	COM1 serial port	0Ch
IRQ5	Reserved	0Dh
IRQ6	Floppy disk controller	0Eh
IRQ7	LPT1 parallel port	0Fh

Figure 2: The table above shows IBM's suggested uses for the 8 IRQ lines in PCs and XTs and the 16 lines in ATs and PS/2s.

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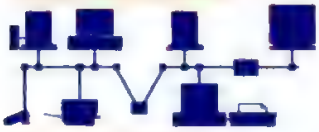

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Tutor

Chances are that your parallel printer adapter uses IRQ7 and your floppy disk drive controller uses IRQ6. And IRQ0 and IRQ1 are already assigned to devices on the system board. Your only recourse is to find an IRQ line that's unused—no easy task when you can't find the documentation for all the installed adapters to determine what IRQ levels *are* used. After a while, the 16 different IRQ levels on an AT start to look better and better.

There are always exceptions to the rule. If you read chapter 4 of IBM's *Personal System/2 and Personal Computer BIOS Interface Technical Reference*, you'll find a discussion of interrupt sharing. It's easier with the Micro Channel because interrupts there are level-sensitive, but devices can share IRQ lines on a standard PC or AT bus. The catch is that software interrupt handlers supporting devices on a common IRQ line must be sensitive to the fact that they're sharing the IRQ channel and must conform to a rigid set of protocols that prevents them from conflicting with each other. The drivers supplied with most boards simply weren't written that way. —*Jeff Prosise*

> The goal is to configure expansion boards so that each one has its own IRQ line.

ASK THE TUTOR

The Tutor solves practical problems and explains points of general interest about using your hardware and software more productively, and answers basic questions about DOS and systems in general. To have your questions answered here, write to Tutor, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see the "By Modem" sidebar in the Utilities column). We're sorry, but we cannot answer questions personally. ■

by
Frank J. Derfler, Jr.

Connectivity Clinic

- CONNECTING AT&T SYSTEMS: If you already have AT&T computer systems, it makes sense to move to AT&T StarLAN for system integration.
- MEMORY CONFLICTS: ARCnet and Above Board memory conflicts are easily resolved.
- USING NONNETWORK SOFTWARE ON A LAN: If your software doesn't support file locking, it can be dangerous to use it on a network.
- NETWORK CRASHES: A bad connection between the data bus and the adapter card in the server can cause mysterious crashes.
- FINDING A WORKSTATION ADDRESS: This simple program will display an adapter address under NetWare.

CONNECTING AT&T SYSTEMS

I am with a federal agency that has AT&T 3B2 400s in approximately 2,300 locations across the country. These supermicros have about 7,000 AT&T 6300s connected to them as terminals. We are evaluating AT&T's StarLAN as a means to connect them all together and distribute processing more evenly. Are there any other LAN systems, like Novell's, that will work with the 3B2? If so, how do they compare? What's the best way to connect all of these systems with an IBM 3090 running MVS?

Bill Bryan
Springfield, Virginia

PC MAGAZINE The name StarLAN refers to a network wiring and signaling architecture created by AT&T that uses CSMA protocols over twisted-pair wire. AT&T gives the name *StarGROUP* to all nonhardware products, including its server software for Unix systems like your 3B2s.

If you connect your AT&T 6300s together as nodes on a *StarGROUP* network instead of as terminals on the 3B2s, you'll have the best of both worlds. The 6300s will still be able to run Unix applications as terminals connected over StarLAN, and the 3B2 will be able to act as a file and print server under the *StarGROUP* software.

The server performance times we measure are like the quarter-mile elapsed times reported by automotive magazines: the numbers reflect performance, but few people need that maximum response. The response times you get from server software on a Unix-based system like AT&T's *StarGROUP* aren't as fast as those you get from a screaming 386 or 486 processor running under *NetWare*, but the service is likely to be good enough for 90 percent of all installations.

Since *StarGROUP* runs over NetBIOS, you should be able to use any of the popular SNA gateway products to connect to your mainframe. Check with the companies we covered in our review of SNA gateways in the December 13, 1988, issue for an update on the compatibility of their products and AT&T's NetBIOS.

My strong advice is to take advantage of the "technology upgrade" clause in your contract and move the AT&T 6300s onto AT&T StarLAN running under *StarGROUP* software. Other solutions offer performance advantages of unknown utility and may greatly complicate your maintenance and support problems.

See the August 1989 issue of *PC Magazine* for an in-depth look at AT&T's StarLAN hardware and *StarGROUP* software. And for more information on this type of networking see "Making Connections: Fast Performance over Telephone Wire" in the September 13, 1988, issue.

MEMORY CONFLICTS

I use a Compaq Deskpro 286 with an Intel Above Board that carries 2MB of RAM as expanded memory. We want to put the Compaq on our ARCnet network running Novell's *NetWare*, but the Pure Data ARCnet card and my Above Board occupy the same memory address. The PC technicians can't find a memory location that will allow me to use my Above Board and the network adapter at the same time. Can you help?

David Zakary
Toronto, Ontario

PC MAGAZINE Intel reports that about 15 percent of the calls it receives on Above Board products deal with ARCnet card memory conflicts. This is because both the ARCnet boards and the Intel board default to a memory address of D000. The easiest thing to do is to move the ARCnet card to memory location CC00. Check the manual or phone Pure Data at (416) 731-6444 for information on the proper switch settings for this address. Since the Above Board addresses only four pages of memory, it will stop at DFFF and won't interfere with the CC00 address.

Remember that you must generate a new *NetWare* workstation shell for this memory address; the process takes only a few minutes. Note that you'll be able to use the new version of the shell only with boards residing at this address, so don't mix it up with the default version of the shell.

USING NONNETWORK SOFTWARE ON A LAN

I hope you can help solve a problem that I'm having with a particular medical office software product. When I purchased this package last year, the company indicated that it could be upgraded to a multiuser system. Now they've informed me that the multiuser option isn't available and that they're dis-

Connectivity Clinic

continuing the product. I asked about using the current software on a LAN, but I was told this wouldn't work, because the software doesn't support file locking.

Can you suggest a solution that doesn't involve buying a completely new program and reentering all of the data?

G. W. Grass
Akron, New York

The only safe way to employ your old software on a LAN is to allow only one person at a time to use the program. You can load the software on a network file server, but if more than one person at a time tries to run the program using the same data files, the second person will probably receive an error message. Even if this doesn't happen, both users run the risk of corrupting the data files or at least destroying each other's current work.

> If you can't live with a one-at-a-time mode, the only solution is to replace the entire software setup.

If you can't live with a one-at-a-time mode, the only solution, unfortunately, is to replace the entire software setup.

NETWORK CRASHES

Our five-node LAN runs *Advanced NetWare* 2.0a on a 286-based 10-MHz AT compatible with a 3Com 3C505 EtherLink Plus card.

Two or three times a week, the network goes down with the message, "Error sending command to 3C505 EhterLink Adapter." (The misspelling is part of the error message.) This error occurs regardless of network load. I run the 3C505 diagnostics following a crash, and the card passes. Although rebooting the server restores the network, the problem is worrisome. Any suggestions?

Mark Lee
Austin, Texas

We've seen the same message. The cause in our case was a bad physical connection between the board and the data bus in the server. Take the 3C505 out of the server. Make sure the contacts on the bottom of the board are clean. You can burnish them with a pencil eraser to brighten them, but carefully get rid of the rubber crumbs. Before putting the board back in the server, look at the contacts on the data bus. Make sure none of them are bent or broken. You might try using a different 16-bit slot. Make sure the board is firmly seated, and that the Ethernet T-Connector doesn't push the board out of alignment. Screw the board in. No guarantees, but we have seen stranger problems cured by reseating adapter boards.

FINDING A WORKSTATION ADDRESS

Some time ago, you published a method by which the physical address of an ARCnet card could be identified. There is a simpler approach available for most Novell installations.

Function call EEh, Get Physical Station Number, will retrieve this information in the CX, BX, and AX registers. I've written a little program called NETNUM.COM that retrieves this information, displays it on the screen, and returns an ERRORLEVEL equal to the lower 8 bits of the physical station number.

The program first takes a look at the logical address of the workstation, using function call DCh. I've observed that a logical number 255 (FFh) is returned when a workstation is not connected to the network and have used this in NETNUM to verify that a machine is actually connected to the network.

This program doesn't work correctly on *NetWare* ELS (Entry Level Systems) packages. These networks always return a physical address of 2, regardless of the card setting.

In newer versions of *NetWare* (ELS-1, 2.10 and later), the option /A has been added to the USERLIST command that will provide the physical address of all logged-in stations.

Robert Soppe
Portland, Oregon

Mr. Soppe's code for finding a network address is too long to publish in Connectivity Clinic. However, it is available on PC MagNet.

Because it's useful to determine a Novell adapter address quickly, PC LAN Labs wrote NETADD.SCR (Figure 1). When NETADD.SCR is redirected to DEBUG, it automatically creates NETADD.COM. To generate the .COM file, at the DOS prompt enter

```
DEBUG < NETADD.SCR
```

This little program will quickly display the adapter address. However, it does not check first to see if you are connected to a Novell network.

NETADD.SCR COMPLETE LISTING

```
N NETADD.COM
A
MOV         AH,EE
INT         21
PUSH        AX
PUSH        BX
MOV         BX,CX
CALL        0117
POP         BX
CALL        0117
POP         BX
CALL        0117
MOV         AH,4C
INT         21
MOV         CL,04
MOV         CH,04
ROL         BX,CL
MOV         AL,BL
AND         AL,0F
ADD         AL,30
CMP         AL,39
JLE         0129
ADD         AL,07
MOV         DL,AL
MOV         AH,02
INT         21
DEC         CH
JNZ         011B
RET

RCX
34
W
Q
```

Figure 1: When this script file is redirected to DEBUG, it produces NETADD.COM, which will display the address of a network adapter card.

NETWORK YOUR QUESTIONS

Connectivity Clinic gives you practical solutions to networking problems of all types. We'll pay $50 or more for any tips we print, *plus an extra $25 if you submit your letter on a disk*. If you do, please include a printed copy. We'll gladly answer your questions at no charge, but we cannot answer letters personally. Mail contributions to Connectivity Clinic, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see the "By Modem" sidebar in the Utilities column). You may also contact Frank J. Derfler, Jr., via MCI Mail (use Derfler's box named CONNECTIVITY CLINIC).■

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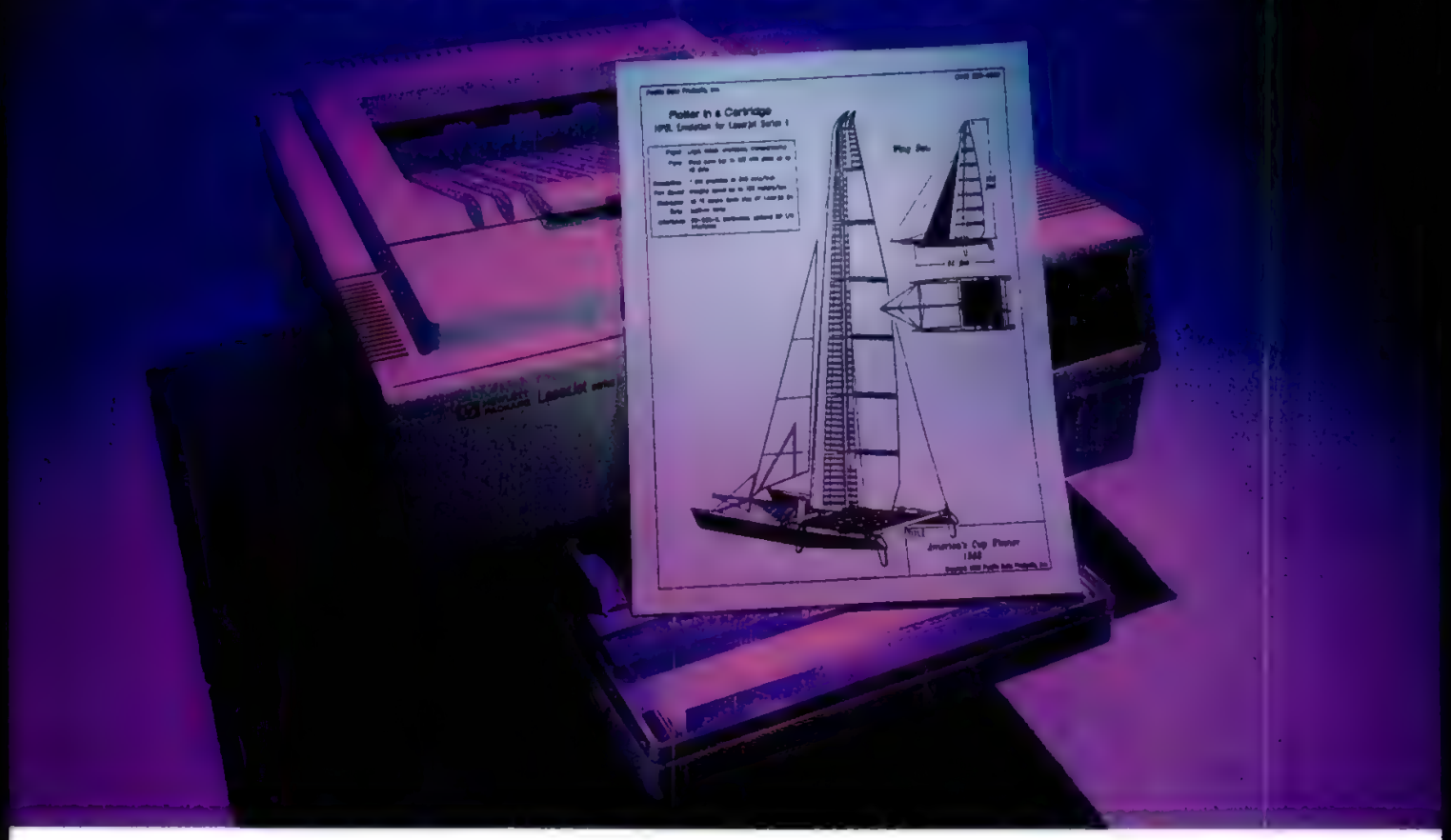

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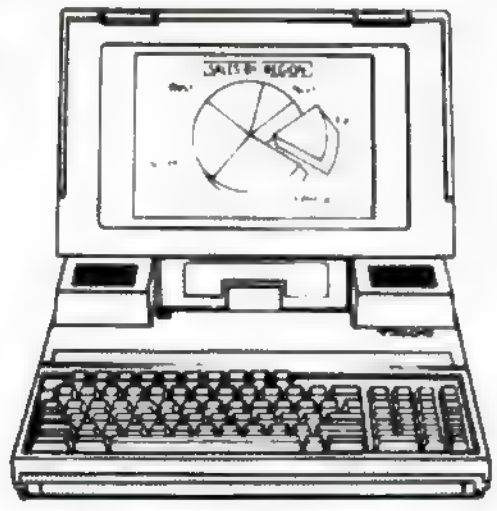

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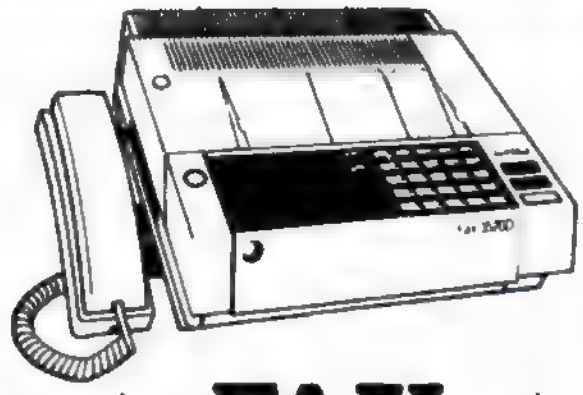

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BIOS	ERSO	ERSO	ERSO	AMI	AMI	AMI	AMI
Wait States	1	0/1	0/1	0/1	0/1	0/1	1
Standard Memory Config	640K	640K	640K	1MB	1MB	1MB	1MB
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Shadow RAM BIOS					384K	384K	384K
Coprocessor Support	8087	8087	8087	80287	80287	80387	80387
Expanion Slots	8-8 bit	8-8 bit	8-8 bit	2-8,6-16	2-8,6-16	2-8,5-16	2-8,5-16
Dual Hard Floppy Controller	w/H.D	w/H D	w/H.D.	Yes	Yes	Yes	Yes
Device Bays(E-external,I-Int.)	4-E	2-E,2-I	2-E,2-I	3-E,2-I	3-E,2-I	3-E,2-I	3-E,2-I
Serial Ports	1	1	1	optional	optional	optional	optional
Parallel Ports	2	2	2	1	1	1	1
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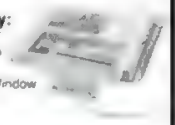

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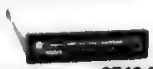

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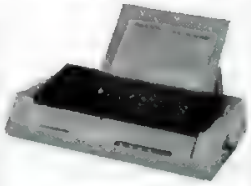

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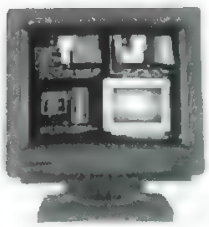

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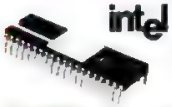

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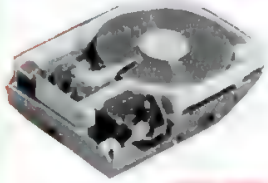

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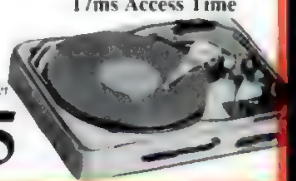

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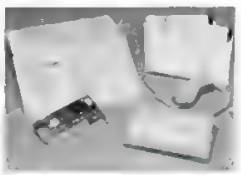

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FX 1050 264 CPS, 54 NLQ	439
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LQ 950 330 CPS, 88 NLQ	519
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Paradox 3.0	445
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DL3400	519
NEC	
P2200	309
P5200	495
P5300	659
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Okidata	
182 Turbo	225
320 (IBM)	335
390 (IBM)	469
393 (IBM)	999
Panasonic	
KXP1180	175
KXP1191	225
KXP1124	297
KXP1595	425
KXP1524	535
KXP4450	1299
Star	
NX1000	167
NX2400	289
Toshiba	
P321SL	439
P341SL	599
P351SX	929

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Megahertz Modems	
2400B Most Toshiba	149
2400B NEC, Epson Mitsubishi or Zenith	189
Mitsubishi	Call
NEC MultiSpeed's	Call
Toshiba	
T1000	639
T1000 768k Card	259
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2400 ETC Int.	147
VGA Wonder 256	259
VGA Wonder 512	309
Everex	
1200B Int Modem	59
2400B Int Modem	119
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Mitsubishi	
1410 EGA	325
Diamond Scan 1381	479
NEC	
Multisync 2a	489
Multisync 3d	645
Multisync 4d/5d	Call
Princeton	
Max15	237
Ultrasync 12"	479
Ultrasync 14"	519
Ultra 16	835
Seiko CM1430	549
Sony	
1302 Multiscan	659
1304 Multiscan	Call
Zenith 1490	595

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Miniscribe	
40MB XT Kit #8450	299
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71MB AT #3085	549
Mitsubishi	
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20MB XT Kit #225	239
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Q & A	197
RapidFile	179
Rbase for DOS	397
Reflex	159

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GEM Desktop Pub.	159
Pagemaker	479
PFS:First Publisher	69
Publisher's Paintbrush	149
Ventura	Call

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Computer Assoc. BPI	Call
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DAC Payroll 3.0	53
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Managing Your Money	113
Peachtree Complete II	139

Graphics

Corel Draw	Call
Deluxe Paint II	45
First Graphics	Call
Freelance Plus	307
GEM Artline	269
Generic Cadd Level 3	149
Harvard Graphics	255
Perspective Jr.	69

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Logitech C7 Serial	59
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Quick Basic	60
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Quick Pascal	60

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GEM First Word Plus	57
Grammatik III	49
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Multimate Adv. II	267
Professional Write	125
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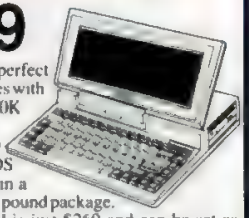
Sprint	117
Q & A Write	109
Word 5.0	Call
Word Perfect	215
Word Perfect Library	59
WordStar Prof. 5.5	189

SPECIALS

Toshiba T1000

$639



The T1000 is the perfect second PC! It comes with 512K of Ram, a 720K floppy drive, a supertwist LCD screen and MS-DOS in ROM! All this in a battery-powered 7 pound package. A 768K Ram card is just $269 and can be set as base, expanded, or a non-volitile Ram disk.

WordPerfect 5.0

$215

The most popular word processor is now even better than ever! Version 5.0 adds multiple font support, graphics integration, page preview and much more. WordPerfect 5.0 still retains its feel and ease of use that made it #1. Combine this with the best support in the industry and you can't lose.

FoxBASE+

$185

FoxBase+ 2.10 is simply the fastest dBASE compatible database software available. FoxBase+ also adds many enhancements to the dBASE language. And it's user-friendly too, its FoxCentral uses pull-down and pop-up menus and you can perform every important database operation without programming! There are even LAN, runtime, and 386 versions available.

FastWrite VGA

by Video Seven

$237

The FastWrite is the fast solution for today's high resolution monitors. Its proprietary technology incorporates high speed data paths to reduce access to memory and sixteen bit connector enhances performance even further. It does a maximum of 800x600 resolution on your multisync-type monitor and is gauranteed VGA hardware AND software compatible.

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The CompuAdd 810

Perfect for word processing, spreadsheet and database applications, the 810 is also an economical alternative for LAN stations that don't need 286 or 386 architecture.

An unbeatable value:

- NEC V20 processor rated at 10MHz
- 640KB RAM with parity checking
- Built-in dual hard drive interface
- Built-in dual diskette drive controller
- Built-in parallel port and two serial ports
- Built-in game port interface
- Three full-size and two half-size XT class expansion slots
- 8087 math coprocessor support
- 5.25" 360KB diskette drive
- Real-time clock
- 101-key enhanced keyboard

Monitor optional.

$595
64700

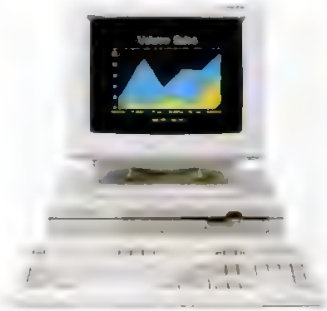
810 Monitor and Hard Drive Options			
	MGA	CGA	CVGA
No Hard Drive	*64701* $690	*64706* $830	*64711* $1130
20MB (69ms)	*64702* $970	*64707* $1110	*64712* $1410
40MB (69ms)	*64703* $1120	*64708* $1260	*64713* $1560

The CompuAdd 212

Far and away the best value on the market in a 286 AT class system, the 212 can handle the toughest MS-DOS®-based software at 12MHz.

- 80286 processor running at 12MHz
- 512KB RAM expandable to 4MB on motherboard
- 0 wait state page-mode memory
- Built-in dual hard drive interface
- Built-in dual diskette drive controller
- Built-in parallel port and two serial ports
- Built-in game port interface
- Three full-size 16-bit and two half-size 8-bit expansion slots
- 80287 math coprocessor support
- Choice of 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- Real-time clock
- 101-key enhanced keyboard

Monitor optional.



$895
64730

212 Monitor and Hard Drive Options			
	MGA	EGA	CVGA
20MB (28ms)	*64731* $1359	*64736* $1709	*64741* $1799
40MB (28ms)	*64732* $1499	*64737* $1849	*64742* $1939
80MB (15ms)	*64733* $1729	*64738* $2079	*64743* $2169

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Every hardware product and every office accessory CompuAdd sells will give complete satisfaction. If not, return it in the original packaging, freight and insurance prepaid, within 30 days of purchase for a full refund of the unit price. Consumable items, opened software, videotapes, and shipping costs not refundable.

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If you experience a problem with anything you purchase from CompuAdd, call 800-999-9901 weekdays from 8:00am to 7:00pm, CST. Our technical support staff will be happy to assist you with any hardware or software difficulty. If we cannot resolve a hardware problem over the phone, we will assign you a return material authorization (RMA) number. You ship the equipment to our Austin Service Center freight and insurance prepaid. We will repair or replace the product (at our option) without cost to you and pay for the return freight. You may also carry the product into one of our North American Superstores where our repair staff can assist you on the premises. Call 800-666-1872 for a copy of CompuAdd's complete warranty.

3. No-Charge 90-Day Express Part or Product Exchange for Mail Order Customers

If a problem affects the service or operation of a component purchased as a CompuAdd system (CPU, monitor, or keyboard) in the first 90 days, we will determine the cause and, if needed, ship a replacement part or product within 48 hours (depending on availability of part), via Federal Express® standard air—at our expense.

4. Onsite Service Available

Onsite service is available within 250 Memorex/Telex service areas nationwide on all CompuAdd systems. The CompuAdd 220 and 300-series systems come with *FREE* onsite service during the initial one-year warranty period. Purchasers of other CompuAdd systems may buy a year of onsite service at the time of purchase. Extended two- and three-year warranties are also available on all CompuAdd systems. *A completed service agreement must be received prior to onset of any onsite coverage. Call 800-666-1872 or visit a CompuAdd Superstore for more information.*

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- 80286 processor running at 16MHz
- 512KB RAM expandable to 4MB on motherboard
- 0 wait state page-mode memory
- Built-in dual hard drive interface
- Built-in dual diskette drive controller
- Built-in parallel port and two serial ports
- Three full-size 16-bit and two half-size 8-bit expansion slots
- Built-in game port interface
- 80287 math coprocessor support
- Choice of 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- Real-time clock
- 101-key enhanced keyboard
- 145-watt power supply

Monitor optional.

$995
64776

216 Monitor and Hard Drive Options

	MGA	EGA	CVGA
40MB	64777	[illegible]	[illegible]
[illegible]	$1599	$1949	$2039
80MB	64778	[illegible]	[illegible]
[illegible]	$1829	$2179	[illegible]
110MB	[illegible]	[illegible]	[illegible]
(15ms)	$2029	$2379	$2469

CompuAdd's New Career Starter Kit

At the heart of the new Career Starter Kit is our most affordable XT-compatible workhorse, the new CompuAdd 810, with its sleek, small footprint design. Surrounding the 810 is a package that contains everything you need to start computing. Monitor. Printer. Cables. Operating and applications software. Even paper and blank diskettes.

$899
64716

- CompuAdd 810 computer (XT-compatible)
- NEC V20 processor rated at 10MHz
- 640KB RAM with parity checking
- Built-in dual hard drive and game port interfaces
- Built-in dual diskette drive controller
- Built-in parallel printer port and two serial ports
- Three full-size and two half-size XT class expansion slots
- 8087 math coprocessor support
- Monographics monitor and adapter
- Star® Micronics NX-1000™ printer and cable
- 5.25" 360KB diskette drive
- CompuAdd MS-DOS v4.01 and GW-BASIC® software
- New Spinnaker® Eight-in-One™ integrated software
- Real-time clock
- 101-key enhanced keyboard
- Computer paper and ten blank diskettes

Color monitor optional.

Career Starter Kit Options

	MGA	CGA	CVGA
No Hard Drive	[illegible]	64722	[illegible]
	$869	$1039	$1339
20MB	[illegible]	[illegible]	[illegible]
	$1179	$1319	$1619
40MB	[illegible]	64723	[illegible]
	$1329	$1469	$1769

The CompuAdd 316s

Power-packed on a small footprint, the 316s opens the door to 386 software at an exceptionally low price. ***Like all 300-series systems, the 316s comes with one year of FREE onsite service.***

- 80386SX processor running at 16MHz
- 1MB memory expandable to 4MB on motherboard
- 0 wait state page-mode memory
- Built-in dual hard drive interface
- Built-in dual diskette drive controller
- Built-in parallel port and two serial ports
- Built-in game port interface
- Three full-size 16-bit and two half-size 8-bit expansion slots
- 80387SX math coprocessor support
- Choice of 5.25" 1.2MB or 3.5"1.44MB diskette drive
- Real-time clock
- 101-key enhanced keyboard
- 145-watt power supply

Monitor optional.

$1495
64787

316s Monitor and Hard Drive Options

	MGA	EGA	CVGA
40MB	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	$2449	[illegible]
80MB	[illegible]	[illegible]	[illegible]
[illegible]	$2329	$2679	$2769
110MB	[illegible]	[illegible]	[illegible]
(15ms)	$2529	$2879	[illegible]

CompuAdd's New Professional Starter Kit

Looking for the value, savings and convenience of a package purchase? Unwilling to sacrifice quality, flexibility, reliability or technical support when you invest in a business computer? Look no further.

Computerize Your Business For $1495
64747

- CompuAdd 212 computer (AT-compatible) **with 40MB hard drive**
- 80286 processor running at 12MHz
- 512KB RAM expandable to 4MB on motherboard
- 0 wait state page-mode memory
- Built-in dual hard drive and game port interfaces
- Built-in dual diskette drive controller
- Built-in parallel printer port and two serial ports
- Three full-size 16-bit and two half-size 8-bit expansion slots
- 80287 math coprocessor support
- Monographics monitor and adapter
- Panasonic® 1180 printer and cable
- Choice of 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- CompuAdd MS-DOS v4.01 and GW-BASIC software
- CompuAdd INTEGRATOR℠ productivity software
- Real-time clock
- 101-key enhanced keyboard
- Computer paper and ten blank diskettes

Color monitor optional.

Professional Starter Kit Options

	MGA	EGA	CVGA
40MB	[illegible]	[illegible]	[illegible]
	$1495	$1845	$1935
80MB	[illegible]	[illegible]	[illegible]
	$1905	$2255	$2345

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Color Video Graphics Array (CVGA) Combo 14" (13" viewable) analog color monitor and a CompuAdd VGA graphics card. *51704* **$579**

Super VGA Combo includes the Mitsubishi Diamond Scan 14" (13" viewable) color VGA monitor and a CompuAdd 16-bit VGA card. *51706* **$745**

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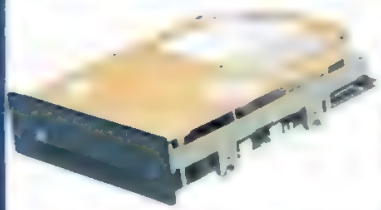
PC Magazine, **Editor's Choice** for Mail Order Hard Disks, June 27, 1989.

Hard Drives



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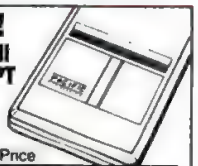

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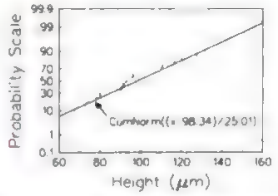

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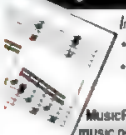

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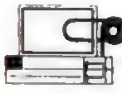

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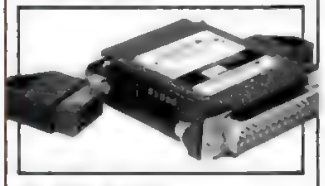

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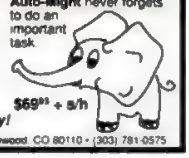

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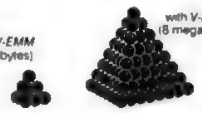

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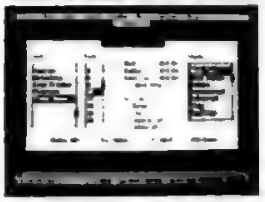

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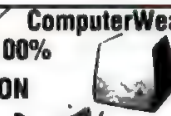

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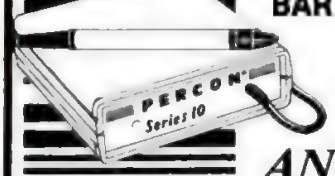

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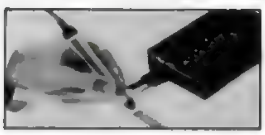

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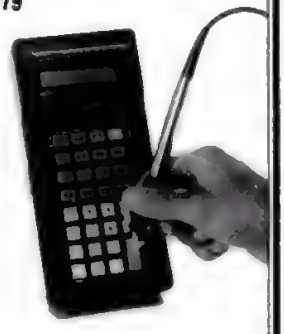

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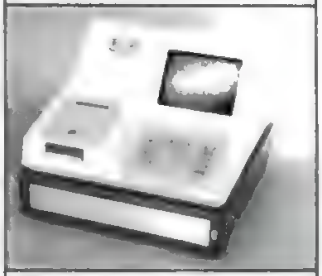

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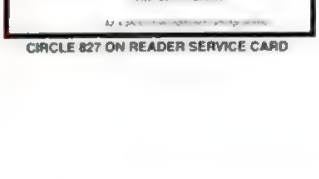

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COMING UP

■ . . . AND THE TECHNICAL EXCELLENCE AWARDS GO TO . . .

At Fall Comdex, *PC Magazine* editors paid tribute to the most exciting products that shipped in 1989—and the people behind them. From utilities to operating systems, printers to PCs, these are the year's most innovative products—and the ones that advance the state of technology.

■ THE BEST OF 1989

From the thousands of products we tested last year, *PC Magazine* editors choose Personal Bests. More than 30 products that were new in 1989 impressed us enough to get the nod.

■ ABORT, RETRY, FAIL?: SPECIAL EDITION

Sometimes dubbed the "worst" of the year, this is really executive editor Bill Howard's look at the bizarre and ridiculous side of the PC industry in 1989.

■ ENDURANCE TESTS

As the new decade dawns, we're launching a new series at *PC Magazine*: Endurance Tests. To address issues of reliability and durability, our reviewers live with selected products, using them every day. You'll see how past Editor's Choices, Personal Bests, and Technical Excellence Award winners hold up over the long haul. 386s and portables are featured in the first installment.

■ DEC'S PC LAN SERVER

Digital Equipment Corp., which has long been the computer industry's second biggest company, is shifting its focus from midrange minicomputers to PC integration. *PC Magazine*'s LAN Labs tests DEC's new PC LAN Server/3100 family. You'll see how it stacks up against *NetWare 386*, Version 3.0. ■

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CIRCLE 115 ON READER SERVICE CARD

After Hours

Products for the Leisure Side of Personal Computing

Bike Training Software Brings Serious Cyclists Indoors for the Winter

PERSONAL FITNESS
by Myron A. Matzkin

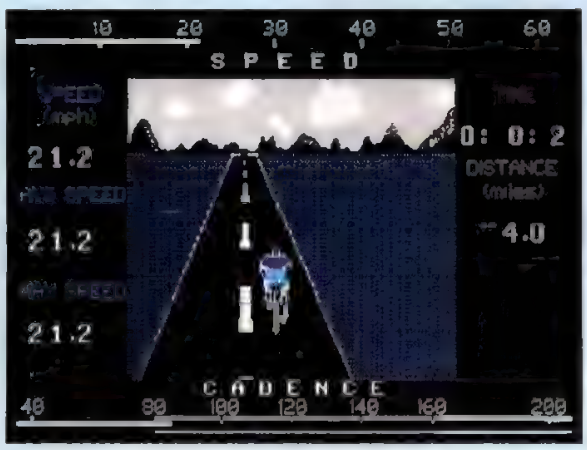
Winter is the time for all good bicycle riders to think of racking it up for a while. Only messengers and madmen continue to ride when it's cold enough to induce pain. Saner cyclists leave the pavement behind in favor of a wind trainer and a computer program that makes indoor training fun and challenging.

Total Distance, from Rank Enterprises, does the job reasonably well without requiring a big cash outlay. The $69.95 combination of hardware and software paces your workout as you pedal along on your wind trainer (a rack that converts bicycles into stationary bikes; not included).

Hardware installation for Total Distance requires a Phillips screwdriver and about 15 minutes of your time. You mount sensors for speed and cadence on the bike's chain-stay. The sensors pick up impulses from magnets that you mount on the rear wheel and the left crank arm of your bike. Plug the cables into your parallel port and you're ready to work out.

When you boot up the software for Total Distance, you can select from the following: a regular workout, a timed workout, a distance trial, a competition mode, a time trial, or a demo.

Choose the competition mode to test yourself in one of four preprogrammed races. Your PC screen shows a rider going off into the distance—until you catch him. Then he disappears. Numeric readouts show your cadence, mileage, time, and distance ahead of or behind the animated pacer.



Total Distance displays a simple graphic of a road course. When you catch the pacer, he disappears.

You had better be in shape if you expect to compete, because these are tough, relatively long rides at high speeds. A better bet is to race against your previous time and shoot for improvement. We liked the time trial feature best. It provides a good, sensible workout that can help you as a rider. It will boost your fitness without destroying you.

The regular workout and the timed workout are okay—but they are liable to lapse into something resembling a ride in the park, since there's no target pace. You simply ride as slowly or as fast as you like.

Unlike the RacerMate system reviewed last year (After Hours, *PC Magazine*, September 27, 1988), Total Distance isn't proprietary. It works with your bike and any wind or mag trainer. (A basic wind trainer will set you back as little as $50.) And Total Distance costs a lot less than the $750 for the RacerMate package. RacerMate graphics and workout possibilities are several giant steps ahead of Total Distance, however.

In conjunction with RacerMate, we also reviewed the Dynalink system from Calladyne Corp., a product more directly comparable to Total Distance. With a $139.95 price ($199.95 with heart monitor), however, the Dynalink program is more expensive. Dynalink displays speed and other information in numeric form without graphics, which makes it less visually engaging. But the Dynalink system is also easier to set up, and the hardware is of visibly higher quality.

If you are interested in a good bike workout at a reasonable price, Total Distance represents a more comfortable alternative to the great outdoors.

List Price: Total Distance, $69.95. **Requires:** 256K RAM, color graphics, two disk drives, parallel port, DOS 2.0 or later. Rank Enterprises Inc., 1202 Hillside Blvd., Wilmington, DE 19803; (302) 322-1717.

CIRCLE 411 ON READER SERVICE CARD

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  Food/Analyst monitors your diet.
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Food/Analyst Specifies The Basic Nutriments in Your Diet

PERSONAL FITNESS
by Don Trivette

We are what we eat, but what exactly are we eating? *Food/Analyst* ($99), from Hopkins Technology, answers that question in greater detail than you'll ever want. A simple hamburger, for example, contains enough ingredients to stock a small chemistry lab. According to *Food/Analyst*, my lunch consisted of minerals (calcium, potassium, zinc), vitamins (B_{12}, niacin, folacin), lipids (saturated fat, cholesterol), and amino acids (lysine, leucine, glutamic acid). And I didn't even have fries.

Hopkins Technology has taken the entire U.S.D.A. food database (known as *Handbook 8* in the food profession) and stored the contents on CD-ROM, along with data on sugars and selected brand-name food products.

CONTINUES

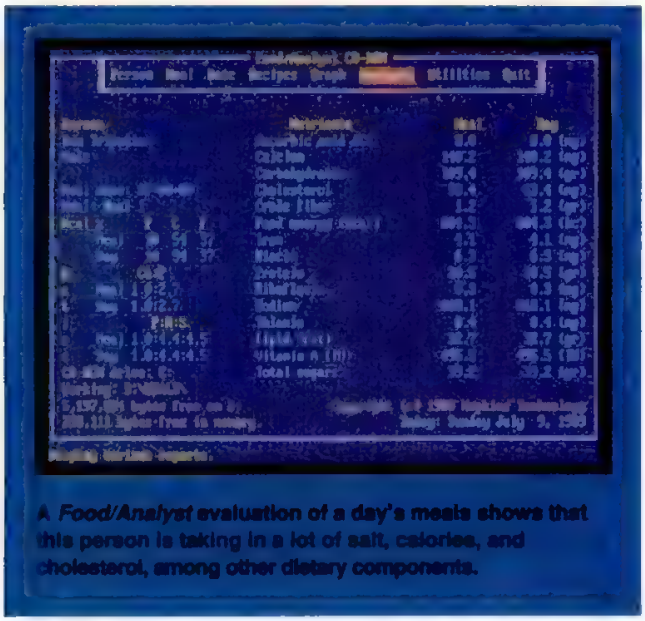
Food/Analyst

CONTINUED

Handbook 8 isn't the skimpy pamphlet the name suggests, but rather a complete nutrient assessment of more than 5,000 foods; in conventional book form, this "handbook" is a multivolume set that takes up almost 3 feet of shelf space.

you're doing versus the minimum daily requirements for a person of your age and gender. There's also a graph option that will visually represent the same data.

You can ask *Food/Analyst* to find, sort, and display all foods that contain a particular nutrient. Feeling low on zinc? Eat oysters or macaroni and cheese. Need more vitamin C? Sweet red peppers have ten times more vitamin C than orange juice. Surprises like that abound throughout the program, as they do in any basic reference work.



A *Food/Analyst* evaluation of a day's meals shows that this person is taking in a lot of salt, calories, and cholesterol, among other dietary components.

Food/Analyst makes all of this data comprehensible and easy to use. First you enter the name or names of the individuals you want to track, then you select from the database the foods that make up their meals. Selecting quantities is particularly easy; the software lets you enter intake as grams, ounces, pounds, or in everyday units like hamburgers, baked potatoes, and 8-ounce drinks.

A recipe feature allows you to calculate the nutrients of your own favorite dishes and add them to *Food/Analyst*'s database.

Food/Analyst's pull-down, point-and-shoot interface is friendly and well designed. You don't need to read a manual to figure out how it works—which is fortunate, because it doesn't have a manual.

Once you've entered a meal (no fudging), the program analyzes the meal's contents. Enter all of your meals for a day and the software will show how well

Food/Analyst is an indispensable tool for food planners and dietitians in places like hospitals, schools, and nursing homes. It's also great for people on diets and those who just want to keep track of exactly what they are eating.

Always remember when using *Food/Analyst*—or any software that analyzes your diet—that changes in your eating habits should be attempted only under the direct supervision of a physician. Software such as *Food/Analyst* should never be used by people to replace the care or advice of health care professionals.

List Price: *Food/Analyst*, $99. **Requires:** 512K RAM; CD-ROM drive; Microsoft CD-ROM extensions; DOS 3.1, 3.3, or 4.0. Hopkins Technology, 421 Hazel Ln., Hopkins, MN 55343; (612) 931-9376.

CIRCLE 412 ON READER SERVICE CARD

WellAware Tracks Down Causes of Food Reactions

PERSONAL FITNESS
by Don Trivette

In a society where food often has its roots more firmly in the corporate laboratory than in the ground, figuring out which foods are doing what to our bodies is no easy task. More than 100 adverse reactions have been linked to food and food additives, and studies indicate that 30 million of us suffer from some form of food sensitivity.

WellAware, from Positech, is a $99 program that helps both the patient and the physician zero in on food sensitivity. Using the program's database of over 3,000 foods, you find what you have eaten over a period of several days or even weeks. Each time you experience discomfort, you select your symptoms (along with the degree of severity) from a list that would make a hypochondriac swoon.

The software has common symptoms and foods built in, but if you don't find an entry that fits, you can add your own aches and pains, and if you don't see what you ate, you can plug in your own recipes. Once you've entered several days' worth of data—the more the better—and several incidents of distress or reaction, *WellAware* goes to work on your problem.

The developers, a doctor and a computer professional, have for the first time collected and organized the substances in food known to cause adverse reactions. These include things like mold, lactose, salicylates, and additives. Although physicians and dietitians have long had lists of food nutrients, ingredients at that level do not produce problems. Instead, it is their combination into complex molecules that often causes distress.

The key to *WellAware*'s savvy is not Jonas Salk–like sensitivity, but rather the power of statistics. *WellAware* uses a sophisticated statistical analysis of the information you provide to produce a list of most likely causes.

The analysis is not a quick process, but it's faster than waiting for a doctor to keep an appointment. *WellAware* takes about 5 minutes on an 18-MHz computer to evaluate three days of meals and symptoms. The manual cautions that more-detailed studies can run 30 minutes to an hour. The output is a list of possible causes (in our litigious society, who wants to say for sure?), ranked from most to least likely.

My only food sensitivity is to flounder, which causes me to itch and sneeze and makes my eyes water. After I ate flounder for several days (well, I pretended), *WellAware* did indeed pinpoint

CONTINUES

WellAware's main menu lets you enter symptoms and record meals. The package diagnoses your food sensitivities and their sources.

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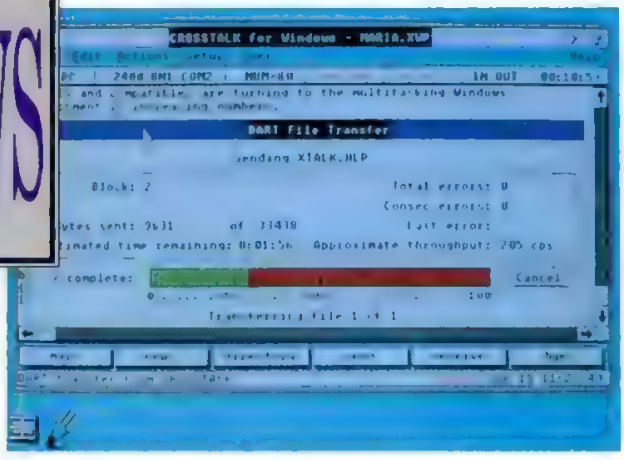

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CIRCLE 278 ON READER SERVICE CARD

After Hours

WellAware

CONTINUED

my sensitivity to the food. But my meager problem wasn't much of a challenge. The software really comes into its own with more-complicated sensitivities, where the cause may be a food additive or a combination of ingredients.

The program is easy to use. Point-and-shoot menus make for quick and easy data entry. A set of picture cards helps even small children describe symptoms, and the comprehensive manual has sections about food sensitivity written for both the lay person and the physician. When used in consultation with a health care professional, *WellAware* can help you understand the causes of some of the unpleasant symptoms and side effects you may have tolerated for years.

List Price: *WellAware*, $99. **Requires:** 512K RAM, two disk drives, DOS 2.0 or later. Positech, 484B Washington St., #350, Monterey, CA 93940; (800) 462-9355.

CIRCLE 413 ON READER SERVICE CARD

The Magic Candle Gives Gamers a New World in Which to Play

GAMES
by Barry Brenesal

The Magic Candle concerns itself with a question that has been so troubling to modern military minds: What do you do with an immortal demon who wants to take over the world and is backed by hordes of slavering monsters? Ali Atabek (*The Magic Candle*'s creator) proposes imprisoning the troublemaker in the flame of an extremely large candle.

Policy reassessment becomes necessary, however, when the candle rapidly diminishes and evil spreads across the land. Now you've been invited by Deruvia's King Rebnard to lead a final, desperate assault. *The Magic Candle* is role-playing fantasy at its most complex and entertaining, easily equaling the recent genre favorite, *Ultima V: Warriors of Destiny* (reviewed in After Hours, *PC Magazine*, March 28, 1989).

Much of the consumer fascination with these role-playing fantasy games arises from the simulation of mythical cultures. The best programs employ ingenious detail to create a real sense of adventure and discovery that never seems to fade. As the game continues, its world only grows more compelling and engrossing.

In *The Magic Candle*, a culture is subtly and engrossingly developed. The graphics are simple but colorful.

The "realism" of Deruvia's pseudomedieval society is cleverly reinforced. Each of your company of 6 adventurers (user-chosen from 13 diversely talented volunteers) is rated in many categories that determine personality, crafts, and battle skills. Once the characters enter population centers, city icons expand to fill several scrolling screens with stores, guards, and inhabitants who follow their own timetables.

Camping outdoors allows your team to hunt, learn spells, and repair weapons rendered dull with use. Naturally, everyone could sleep instead, decreasing fatigue. But another, nastier side of reality is the ever-present likelihood of ambush.

A twist to *The Magic Candle* not usual in these programs is its time limit: 800 days to figure out what to do with Dreax the Arch-Demon and carry out your plan. Otherwise he escapes and turns Deruvia into one vast parking garage for his evil legions. Each of your party's activities costs a certain amount of time. All the places and people you have to visit to acquire information, skills, and weapons consume a great deal of time. Mapping is not really necessary, but some parchment and quills for jotting down advice are indispensable.

The documentation is amusing, purporting to represent the sometimes-contradictory advice of experts in King Rebnard's court. *Magic Candle*'s battle system is similarly imaginative; it supports weapons exchanges during conflict and positioning options for all characters.

The various nasties employ differing attack strategies against your team, according to their natures. Some look for the most powerful opponent. Others prefer to take out the magic users. Several just grin toothily and gang up on the wimpiest recruit you've got.

A fantasy-game first is the ability to divide your group into smaller, separate units, all the way down to individuals. Several activities can be accomplished simultaneously in this fashion, though it isn't a very safe trick to try outdoors.

The graphics are simple and icon-oriented, but the color palette is broad and subtly applied. Versions 1.1 and 1.2 of *The Magic Candle* had some problems with error recovery, sometimes locking up when noncommand keys were accidentally hit. The publisher, cognizant of this, will send the Version 1.3 disk of 19 revised files free of charge to owners of the earlier editions, upon receipt of the warranty card.

Perhaps the best thing about *The Magic Candle*, though, is that the game represents only the first volume of a projected adventure series. If you enjoy role-playing software, you'll like this first installment and will eagerly await the appearance of volume 2.

List Price: *The Magic Candle*, Volume 1, $49.95. **Requires:** 256K RAM, CGA or EGA card and monitor, DOS 2.1 or later. Electronic Arts, 1820 Gateway Dr., San Mateo, CA 94404; (415) 571-7171.

CIRCLE 414 ON READER SERVICE CARD

Variety Magazine Offers Its Film Database on CD

VIDEO
by Don Trivette

If you didn't read the book because you were waiting for the movie, and you didn't see the movie because you were waiting for the tape, and you didn't see the tape because you forgot, you should know that there's a new PC product that tells you when and where to find any retail video software.

Variety's 1,300-plus-page *Video Directory*—an epic tome with more than 42,000 titles—is now a computer-searchable database available on CD-ROM. Just slip the shiny disk into your CD-ROM player, install the search software, and explore to your heart's content.

Like the book, the CD-ROM is marketed as an annual subscription, with quarterly updates included in its $295 price. Designed primarily for libraries and video stores, *Variety's Video Directory Plus* is nevertheless a super resource for the avid film buff. It even includes hundreds of adult titles—password-protected, if you choose—but, alas, without descriptions.

CONTINUES

After Hours

Variety Video

CONTINUED

There are dozens of ways to search the directory, including by title, performer/director, award, keyword, subject, and year released. In less than a jiffy you can determine that Rob Lowe has 10 films in video release, get a list of the 11 recent winners of the grand prize at the Cannes International Film Festival, and browse through the 1,155 films cited in the Western category. You can even combine search terms: Did Rob Lowe star in any award-winning cowboy films? (No.)

***Variety's Video Directory Plus* offers a number of ways to find films, including by title, keyword, subject, and performer. You can also combine search terms.**

There are dozens of ways to search the directory, including by title, performer/director, award, keyword, subject, and year released. In less than a jiffy you can determine that Rob Lowe has 10 films in video release, get a list of the 11 recent winners of the grand prize at the Cannes International Film Festival, and browse through the 1,155 films cited in the Western category. You can even combine search terms: Did Rob Lowe star in any award-winning cowboy films? (No.)

Once you've selected a film (by title, performer, date, award, etc.), pressing a function key brings up the cost, distributor, ordering information, media (VHS, Beta, Laserdisc), and sometimes a description. Not all films are summarized, but *Variety* is adding new descriptions as they become available from film distributors. The software has an electronic ordering feature, although the manual cautions that most vendors are not yet ready to process orders electronically. On-line ordering is certainly something to look forward to, though.

By this fall, the CD-ROM *Video Directory Plus* will include *Variety*'s own full-length reviews of major videos. Eventually sound and graphics will be added so that you can see stills from the films and hear cuts from the soundtracks. In fact, the review copy I received included photographs from *Gone with the Wind*, *A Fish Called Wanda*, and *Casablanca*, but we can't show them because the publisher was still negotiating with the studios. On a VGA monitor, the display quality begins to approach that of television.

Variety's Video Directory allows you to bring your PC into your home entertainment system in a particularly painless way. The program provides a comprehensive database of video titles without forcing you to obtain and maintain the information yourself.

It won't be long before we'll be able to review film clips at our computers and then order rental copies to be delivered to our doors—along with two large popcorns, please.

List Price: *Variety's Video Directory Plus*, $295. **Requires:** 640K RAM, CD-ROM player, Microsoft CD-ROM extensions, DOS 3.0 or later. Bowker Electronic Publishing, 245 W. 17th St., New York, NY 10011; (800) 323-3288, (212) 337-6989. ■

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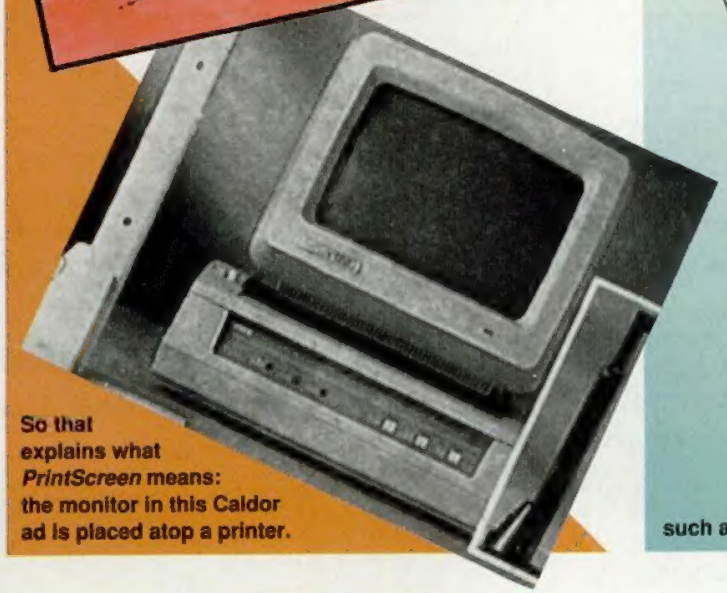
by Bill Howard

Abort, Retry, Fail?

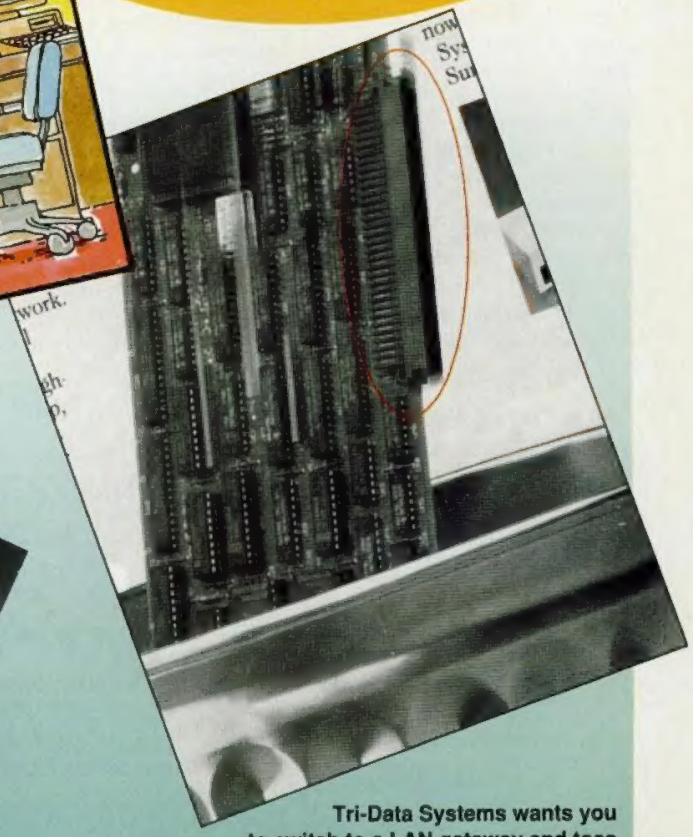
The Lighter Side of Personal Computing

Straight Talk About PCs—For Lawyers, from Lawyers

"To establish a network, you will need to purchase a personal computer for each workstation and an additional, larger computer, known as the fireserver. . . ."
—*Lawyers Alert,* August 21, 1989



So that explains what *PrintScreen* means: the monitor in this Caldor ad is placed atop a printer.



Tri-Data Systems wants you to switch to a LAN gateway and toss out your IRMA (or similar) card—but don't be in such a hurry that you yank out the motherboard connector, too.

Duck, Jerry— Here Comes Another Bit!

"The [IBM] 0661 drive comes with a SCSI II interface, has eight platters and a blazing data transfer rate of 12.5 milliseconds, the fastest in the industry."
—*Computer Systems News,* August 14, 1989

Geez—What'll We Do with All That Contiguous Disk Space?

"Scott praised the enhancements in NetWare 386 over its predecessor, Advanced NetWare. He was especially pleased with the added security features and the increased hard disk volume size from 360K bytes to 1.2M bytes. . . . Scott said, 'I don't have to ride herd on my network users to purge inactive files.' "
—*Network World,* August 7, 1989

PC Magazine offers $50 and a *PC Magazine* T-shirt if we use your submission in Abort, Retry, Fail? Warning: Don't write on the original if it might be reprinted; mark up a photocopy or use a Post-it. In case of duplicate entries, the neatest entry wins. Winners this issue: Frank Han (monitor on printer), Joel Richmond (Tri-Data), David Kearns (NetWare 386), Forrest Robleto (12.5 milliseconds), Gary Bolt (fireserver).

ILLUSTRATION: RICHARD TENNANT

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